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THE
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Vol. XXXIV ST. LOUIS, NOVEMBER, 1924. No. 11

ORIGINAL COMMUNICATIONS.

(Original Communications are received with the understanding that they are contributed exclusively to THE LARYNGOSCOPE.)

ON THE LOCALIZATION OF OTOLITH FUNCTION.*

DR. S. S. MAXWELL, Berkeley, Calif.

I. In no other field of physiological research have conclusions been so often vitiated by a priori considerations than in the study of the functions of the labyrinth. The extraordinary space relations of the semicircular canals suggest functions having to do with symmetrical planes of the body, and with reactions to movements or changes of position with reference to those planes. Experimental work seems to justify, in part does justify, these conclusions; but the farther generalization has been arrived at that the semicircular canals, or more properly, the sensory structures connected with them, have to do with the perception of angular movement, or the reaction to it, and that the otolith organs have to do with posture reflexes or the perception of position of the body with reference to the lines of gravitational force. Thus Breuer[1] emphasizes the distinction between dynamic and static functions, attributing the former to the semicircular canals and the latter to the otolith organs. He states that "the three (or two) otolith apparatuses stand in just as constant space relations to one another as the three semicircular canals". He then goes on to describe with care and at considerable length the position and character of the three otoliths in the various groups of vertebrates. He emphasizes that all vertebrates from the teleosts up, with the

*Experimental part with the collaboration of Richard E. Orme.
(From the Rudolph Spreckels Physiological Laboratory of the University of California.)
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exception of mammals, have three otolith organs on each side, namely, the maculae of the utriculi, the sacculi, and the lagenae.

It seems to have been assumed by many that the three otoliths stand in definite relation to the lines of gravitational force in such a way as to form collectively an organ for static equilibrium. In recent years this conception has been much strengthened by the works of Magnus and de Klein and their collaborators. These investigators have taken great pains to determine with exactness the precise position of the otoliths in the rabbit ear. They have in extensive and painstaking researches studied the reactions of mammals to rotations in all planes and also the reflex positions assumed by eyes, head and limbs which result from placing the body in various postures. In these studies they have emphasized the distinction between static and dynamic functions. The static reactions they have referred to tonus effects of the otolith organs; the dynamic to the semicircular canals.

In support of their conception of the posture reflexes as reactions brought about through the otolith organs de Kleyn and Magnus have presented the following experimental evidence: Guinea pigs which have been centrifugalized at a certain very high rate of speed are found to be still able to respond to rotations by the appropriate compensatory movements, which indicates the integrity of the parts concerned with the dynamic functions; but when these animals are rotated into an abnormal position and held in this position the eyes do not retain the compensatory position as would be the case in an uninjured animal. Histological examination of the ears of such animals shows according to de Kleyn and Magnus[2] a definite injury to the otolith organs and not to the semicircular canals. Moreover, the part of the otolith membrane injured depends upon the position in which the animal was fastened while being centrifugalized. The results are interpreted to show that the compensatory movements occurring during the rotation depend upon the semicircular canals, but that the posture reflexes are tonus influences from the otoliths. These conclusions are in striking conformity to the a priori conceptions of Breuer and Mach, but they are at the same time so absolutely inconsistent with the results obtained on fishes and amphibians that it seems worth while to review the latter experiments.

II. As stated in the previous section Breuer indicates the importance to his hypothesis of the co-operative activity of three otoliths in the three planes in space, the three thus constituting an organ for the mediation of static functions. It is of particular

interest to know experimentally the relations of these otoliths to the posture reactions in the fish and the amphibian, since in these animals that part of the labyrinth concerned with equilibrium is so highly developed, while the part which is recognized in the mammal as the organ of hearing is still in the most rudimentary state. It should be possible in these lower vertebrates to put the otolith hypothesis to a crucial test. This has actually been done.

Laudenbach[3] removed the otoliths from the ears of an amphibian, Siredon pisciformis, and saw that there were no deviations from the normal in the equilibrium reactions of the operated animal. He performed the same operation also on frogs and with the like result. Ach[4] repeated Laudenbach's experiments on the otoliths of the frog and confirmed his findings. Although there was no equilibrium disturbance and no loss of static functions, Ach discovered that the operated frogs showed certain departures from the normal, namely, three reactions, which he named the Stirn-reflex, the Schrei-reflex and the Lid-reflex. The first two of these can, by no stretch of the imagination be called equilibrium reflexes. The third consists of closing of the eyes in response to sudden rectilinear movements and does not come into consideration here. Strange to say, however, Ach makes in this connection, the following extraordinary statement, "I can here remark that my results form an experimental confirmation of the Breuer-Mach hypothesis of the otolith function".

It should be pointed out that while Laudenbach and Ach speak of removing the otoliths, what they really did was to remove the large otolithic masses of the sacculi and lagenae apparently leaving untouched the small and relatively inaccessible otoliths of the utriculi. Parker[5] and I[6] each made similar experiments on the dogfish with the like result, namely, that no disturbance of the static or dynamic functions occurred.

III. The experiments described in the preceding section did not sufficiently discriminate between the functions of the different otoliths and those of the other parts of the labyrinth. I[7] showed, however, in later work that in the dogfish when the three ampullae of each ear have been destroyed and the otoliths have been removed from the sacculus and lagena, the normal compensatory positions are retained when the fish is placed in any oblique position. There is left, in this case, only the macula utriculi with its otolith. When this otolith also is removed all the reactions cease. Moreover, I[8] found that by appropriate mechanical stimulation of the macula utriculi movements of the eyes can be produced exactly

like those resulting from the placing of the normal animal in any oblique position whatever. Magnus and de Kleyn, basing their conclusions on experiments on mammals, consider the posture reflexes to be the result of tonus changes excited through the otolith organs, while apparently the semicircular canals are not supposed to have tonic influence on the muscles. In the dogfish, however, I[9] found on the contrary that definite tonic effects of the ampullae could be demonstrated, while I was wholly unable to prove that such influence can originate in the maculae.

IV. EXPERIMENTAL PART BY S. S. MAXWELL AND RICHARD E. ORME.

The above experiments should make it perfectly obvious that in the fish all the labyrinthine posture reflexes, to use the terminology of Magnus, can be obtained through the action of the maculae utriculi alone and that the otoliths of the sacculus and lagena have nothing to do with these functions. That the same is true for the frog will now be shown.

We removed from both ears of the frog the otolith material of the sacculus and lagena by the method of Ewald.[10] The completeness of the operation was determined by careful post-mortem examination under a lens. In order that the effect of retinal images should be excluded, the eyes were in some cases enucleated, in others, the animals were blinded by the injection of a drop of 10 per cent chromic acid into each eyeball. Frogs which had been prepared in this way made a good recovery and could be kept in excellent condition.

When the frog operated as above is placed on a board and tilted into a head down position the animal makes the same compensatory movements as a normal frog, that is to say, the snout is elevated. When tilted into a head up position the snout is depressed. When rotated around the longitudinal body axis to the right and held in this position, the head rotates to the left on the body, and retains, so far as the anatomical structure will permit, the original horizontal position. In each case the position is maintained indefinitely so that there can be no doubt of the integrity of the posture reflex mechanism of the labyrinth. If the whole labyrinth is destroyed, the reaction no longer occurs. It might have been objected that we had not excluded the orienting effect of contact stimuli. This, however, was easily done by wrapping the frog in a damp towel

[9] Since this paper was sent to the printer the writes has just received an article by Karl Grahe (Arch. f. d. ges. Physiol., 1924, 204:421). This work done in Magnus' laboratory shows that irrigation of the auditory canal with hot or cold water produces, in addition to the well known ocular nystagmus, definite tonus reflex effects on the muscles of the fore limbs. Grahe assumes that the stimulation results from currents of liquid in the canals. If the premises are correct posture reflexes can come from the ampullae in the rabbit as well as in the fish.

with the head protruding. When held in the hand in this way the contact stimuli are practically the same, no matter into what position the animal is tilted. The compensatory positions were in each case assumed and retained. We must conclude as the result of these experiments that in the frog either (1) the posture reflexes for oblique positions in all planes can be mediated by the otolith organ of the utriculus alone or (2) that the semicircular canals have definite static functions; neither of which conclusion can be harmonized with the generalizations of de Kleyn and Magnus on the labyrinth function of mammals. We feel that so extraordinary a divergence between these groups of vertebrates requires further investigation.

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ASYMMETRY OF THE MOUTH OF THE ESOPHAGUS AND RETROPHARYNGEAL DIVERTICULAE.*

DR. HARRIS P. MOSHER, Boston, Mass.

Lately I have made what were to me some new observations on asymmetry of the thyroid cartilage and the mouth of the esophagus. Three years ago I reported before this Society a series of cadaver findings in specimens showing cricoid webs. These specimens have been gone over again in the light of my present findings, especial attention being given to asymmetry of the pyriform sinus. This study set me to speculating on the causes of pouches of the upper end of the esophagus. It proved to be easy after a little experimenting to make an artificial pouch on a wet specimen of the esophagus. Retropharyngeal diverticulae or esophageal pouches have long been held to be hernia of the esophageal mucous membrane through the anatomatically weak spot of the posterior wall of the esophagus. A reason for the unequal strain or the over strain to start the hernia has been unknown to me. I feel that I have come upon at least one possible cause for this. The cause is asymmetry of the pharyngeal funnel due to asymmetry of the larynx, the pyriform sinuses or the mouth of the esophagus. I am well aware that in anatomical discussions asymmetry is loaded with the burden of many an argument, and is often overworked. If I overwork it this Society is abundantly able to correct me.

The order of the subjects dealt with in the paper is as follows: cricoid webs in the cadaver and in the living; asymmetry of the pyriform sinuses, of the thyroid cartilage and the mouth of the esophagus; the mechanism of pouches of the upper end of the esophagus; asymmetry as a possible cause for the starting of such pouches.

Clinically I have found more unilateral than bilateral webs, and more webs on the right than on the left. Webs, can occur on any part of the posterior surface of the cricoid cartilage. Thin diaphragm like webs with a small central opening are usually found at the lower border of the cricoid cartilage.

Some years ago I pointed out that in order to X-ray the pocket made by a cricoid web it was necessary to X-ray the side of the larynx. Until this observation was made I never understood why

*Read before the American Bronchoscopic Society, St. Louis, May 28, 1924.

*Unless credited to others the X-ray plates were taken by Dr. A. S. Macmillan, of the X-ray Department of the Massachusetts Eye and Ear Infirmary. Drawings by the writer.

I could find webs with the esophagoscope and yet never detected them in the X-ray. This year I appreciated for the first time the extreme redundancy of the mucous membrane on the posterior surface of the cricoid cartilage, about the posterior end of the pyriform sinuses, and round the mouth of the esophagus. I have long known that it could easily be thrown into folds and pockets by the end of a small examining tube. Edema of the arytenoids is given great play owing to the laxity of the mucous membrane. This laxity is necessary for the free play of the arytenoids, and in order to allow the normal stretching of the lower pharynx and the mouth of the esophagus.

A number of years ago I examined ten jar specimens of the larynx, which had the upper end of the esophagus attached and un-

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Fig. 1. Specimen of a larynx and the upper end of the esophagus showing the size and shape of the opening at the beginning of the esophagus. Reduced one-half.

Fig. 2. Web of the Esophagus. Specimen of a larynx and the upper end of the esophagus showing a single web springing from the upper rim of the posterior surface of the cricoid cartilage a little to the right of the median line. The esophageal opening is small and is found to to left of the web. The lumen of the right half of the beginning of the esophagus is obliterated. Reduced one-half.

opened, and found four unilateral webs of the right pyriform sinus and two bilateral webs, that is, a web in each pyriform sinus. At that time I considered the webs either ulcerative or traumatic in origin. Ever since this finding I have been aware that these webs were very common. See Figs. No. 1, 2, 3, and 4.

Asymmetry of the Pyriform Sinuses: The transverse diameter of the pyriform sinus may be narrowed or the antro-posterior diameter shortened. For instance, in one specimen the left pyriform sinus extended anteriorly to the tip of the vocal process of that

side, whereas on the right the sinus extended to a point half way between the vocal process and the anterior end of the cord.

The inner wall of the pyriform sinus is the aryteno-epiglottic fold. This is a triangular fold running from the whole of the side of the arytenoid forward to the side of the base of the epiglottis and the inner surface of the thyroid cartilage. The base of the fold corresponds to the height of the arytenoid, that is, it measures about half an inch. Externally the inner surface of the thyroid cartilage prolongs the sinus backward a little beyond the posterior border of the arytenoid cartilage. (See Fig. 8.)

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Fig. 3. Web of the Esophagus. Specimen of a larynx and the upper end of the esophagus showing a gluing of the right half of the beginning of the esophagus to the posterior surface of the cricoid. Reduced one-half.

Fig. 4. Webs of the Esophagus. Specimen of a larynx and the upper end of the esophagus showing two webs, one on either side of the median line. They are symmetrically placed and each one springs from the upper rim of the posterior surface of the cricoid. The opening of the esophagus is small. Reduced one-half.

In the mirror examination of the larynx we are accustomed to see the upper edge of the aryteno-epiglottic fold only and not to appreciate how far it extends downward. In most cases it bounds a pocket which will easily take the tip of the little finger. A considerable amount of food or fluid therefore can lodge in the pocket.

Asymmetry of the Thyroid Cartilage and of the Mouth of the Esophagus: Recently I made a systematic examination of a series of frozen sections of the neck and thorax, my purpose being to study the variations of the pyriform sinuses, to notice the presence of webs in the pyriform sinuses or webs springing from the posterior surface of the cricoid cartilage and running to the posterior wall of the esophagus and so narrowing the beginning of the esophagus.

The first point which I noticed was the frequent asymmetry of the two halves of the thyroid cartilage—four cases out of eight—

the asymmetrical side being straighter than the other and nearer the cricoid cartilage.

In one case in which there was marked asymmetry of the right half of the thyroid cartilage the lower half of the right half of the posterior face of the cricoid cartilage was glued by adhesions to the posterior wall of the esophagus. The mouth of the esophagus was pushed to the left but was not narrowed.

Fig. 5. Drawings showing three views of a post-cricoid web. The upper drawing shows the web as it was first seen. The middle and lower drawings show the web as it was put on the stretch by strong ballooning. On the left the round knob is the remnant of a web which was broken by the passage of a bougie sixteen years before. The passage of the bougie relieved the patient for a few years. For three or four years before the patient was seen by the writer she was reduced to fluid diet. She complained of frequent attacks of strangling. The web on the right was bitten away. Bougies were passed a few times. The patient regained normal swallowing. Natural size.

In the second case there was slight asymmetry of the right half of the thyroid cartilage and the whole of the right half of the posterior face of the cricoid cartilage was glued to the posterior wall of the esophagus. The whole right half of the mouth of the esophagus was obliterated.

In the third case there was slight asymmetry of the right half of the thyroid cartilage. Both pyriform sinuses were free of adhe-

sions. The mouth of the esophagus was in the middle line but was only half the normal width.

In the fourth case there was only slight asymmetry of the halves of the thyroid cartilage. In this case there was no deformity of the pyriform sinuses and the mouth of the esophagus was in the median line and of normal width.

Fig. 6. Web of the Esophagus. Drawing of a larynx and the upper end of the esophagus. The esophagus is cut posteriorly in the mid-line and the two flaps turned outward. Beginning at the top of the cricoid cartilage the right half of the esophagus is glued to its posterior wall. The transverse section of the esophagus shows that the anterior and the posterior walls are firmly united. The left half of the esophagus reflects freely from the posterior surface of the cricoid. The fusion of the two walls of the right half of the esophagus continued for half an inch below the line of transverse section shown in the drawing. Reduced one-half.

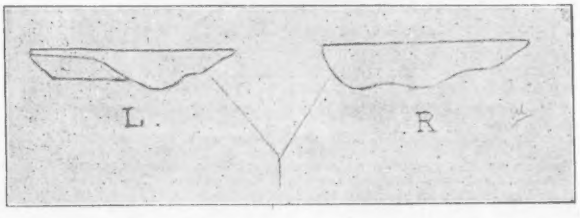


Fig. 7. Drawings of wax casts of the pyriform sinuses of a wet specimen of the larynx showing bilateral webs springing from the posterior surface of the cricoid cartilage on its upper outer borders. The webs turned the pyriform sinuses into definite pockets. Natural size.

The fifth specimen was a fresh specimen from the dissection room. There was a very marked asymmetry of the right half of the thyroid cartilage. The superior horn was thicker than the left and there was a cartilaginous nodule above it. There was no nodule above the left posterior superior horn. The right half of the mouth of the esophagus was obliterated to the middle line. The condition

of the right pyriform sinus could not be determined, because the mucous membrane had been cut at this point in the dissecting room. The obliteration of the right half of the mouth of the esophagus in this case was the same as in specimen No. 2, although in specimen No. 2 there was only slight asymmetry of the two halves of the thyroid cartilage where as in this fifth case the asymmetry was very marked. In this fifth case the remainder of the esophagus was of normal width. So it was in specimen No. 2.

Pouches of the Upper End of the Esophagus: The mechanism of pouches of the upper end of the esophagus has never been clear

Fig. 8. Photograph of a wax cast of a wet specimen showing asymmetry of the larynx. The cast is seen from behind. Notice that the left ventricle of the larynx is much larger and higher than the right. The left pyriform sinus is smaller and higher than the right. There is no asymmetry of the mouth of the esophagus. Natural size.

to me. I have never found a pouch in a dissecting room subject. I never could find in the books an embryological explanation for the formation of a pouch. I have always had the feeling, however, that an embryological reason might some day be found. In the Fourth Edition of Keith's embryology published in 1891, page 271, in the paragraph on the esophagus, the following statement is made: "Its commencement is surrounded by a sphincter formed by part of

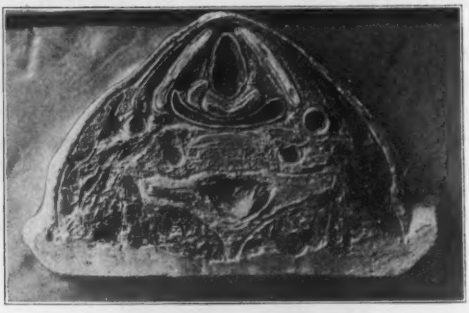


Fig. 9. Cast from frozen section—adult, showing the larynx and the lower pharynx just above the mouth of the esophagus. In the section the pharynx at this point is a mere slit. Before taking the cast the pharynx was opened slightly in order to show its normal shape. Reduced one-half.

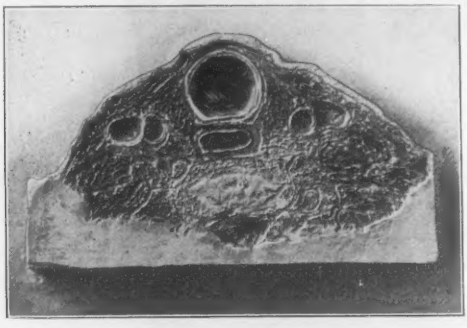


Fig. 10. Cast of the lower surface of section No. 1. It shows the normal width and position of the esophagus. Reduced one-half.

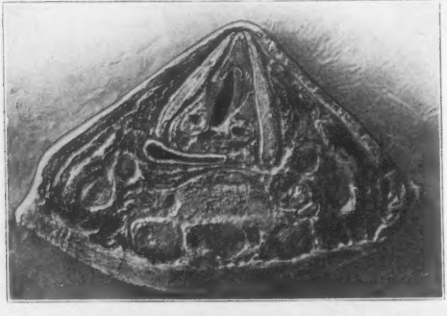


Fig. 11. Cast from a frozen section—adult, showing a very asymmetrical larynx. Beginning half-way down the posterior surface of the right half of the cricoid cartilage the mouth of the esophagus for a third of its transverse diameter is obliterated by adhesions springing from the cricoid cartilage. Compare with Fig. No. 9.

the inferior constrictor of the pharynx. Above this sphincter, in later life, a pouch (retropharyngeal diverticulum) may arise. Such pouches are never congenital in origin."

In spite of this statement my faith in an embryological mishap as a contributing cause for esophageal pouches still abides. My reason for this is that I have recently found, as stated above, three cases of asymmetry of the thyroid cartilage in a series of eight sets of frozen sections of the thorax, and in each of the three cases one-half of the lumen of the mouth of the esophagus was obliterated, the obliteration occuring on the side of the deformed half of the thyroid cartilage.

Posteriorly the lower edge of the inferior constrictor of the pharynx ends in a thickened edge. This is readily appreciated if the finger tip is placed in the beginning of the esophagus in a wet specimen of the pharynx and the upper end of the esophagus, the head, pharynx and esophagus having been separated from the spine. In such a specimen—this is the routine dissecting room specimen prepared by all students—the finger readily appreciates any weak spot in the pharyngeal wall, because the pharynx is not reinforced by the bony wall of the spine. One is surprised to find how firm and band-like the lower edge of the constrictor feels to the finger tip and how flabby the posterior wall of the esophagus is just below the edge of the constrictor.

This flabby spot has long been known as the weak spot of the esophageal wall. It is triangular in shape. It is bounded above by the lower edge of the inferior constrictor, on the sides by the longitudinal muscles of the esophagus which fork to make the apex and the sides of the triangle and pass round the esophagus laterally to meet in front and gain an attachment to the median ridge on the posterior face of the seal of the cricoid cartilage. The body of the triangle is filled by the transverse circular fibres of the esophagus. Above, these fibres are continuous with the lower fibres of the inferior constrictor. Below the weak triangle the circular fibres of the esophagus are reinforced by the longitudinal fibres. In the weak triangle the circular fibres lack this support. An esophageal pouch is a hernia of the esophageal mucous membrane backward through the weak triangle.

The beginning of the esophagus is an especially bad place to have a weak spot. Food and drink often come to the entrance of the esophagus en masse, food in half-chewed boluses and fluid in gulps. The back of the cricoid cartilage strengthens the mouth of the esophagus in front and the spine reinforces it behind. It can

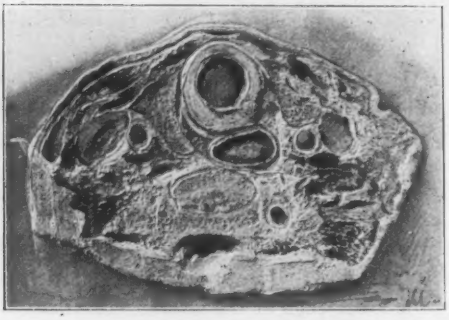


Fig. 12. Cast of the lower surface of section No. 2. The esophagus is somewhat to the left of the median line. Its lumen is of normal width. Reduced one-half.

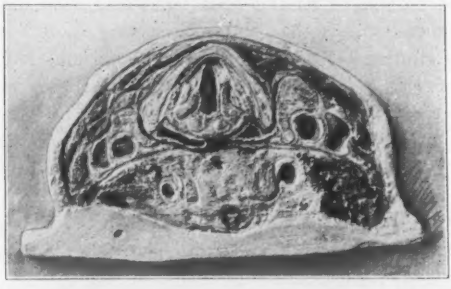


Fig. 13. Cast from a frozen section—adult. The larynx is symmetrical. The right half of the mouth of the esophagus is obliterated. On the right there is a small triangular depression showing an attempt to start the mouth of the esophagus at this point. Reduced one-half.

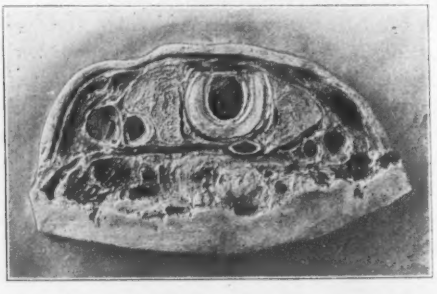


Fig. 14. Cast showing the under surface of section No. 3. The esophagus is only half its normal width, the right half being obliterated. Reduced one-half.

Fig. 15. Drawing of an artificial pouch made on a wet specimen of the larynx, trachea and esophagus by separating the fibres of the esophagus transversely in the triangular area and then making backward pressure on the esophageal mucous membrane. Reduced one-half.

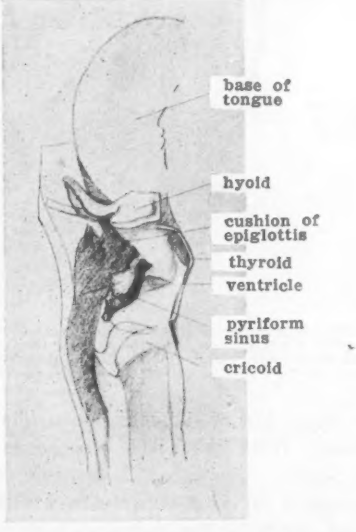


Fig. 16. Tracing of an X-ray of a wet specimen of the larynx and lower pharynx filled with barium. This X-ray was taken in order to get the anatomical landmarks in their relation to the barium shadow. Compare with Figs. No. 17 and 18. Reduced one-half.

expand readily only at the sides. In this lateral expansion lies its safety in gluttonous and rapid swallowing.

When the tips of the arytenoids are forced against the cushion of the epiglottis—that is when the larynx is closed for swallowing—the posterior surface of the arytenoids and the posterior surface of the cricoid cartilage make a plane which is inclined backward and downward. This inclined plane shoots food and fluid backward

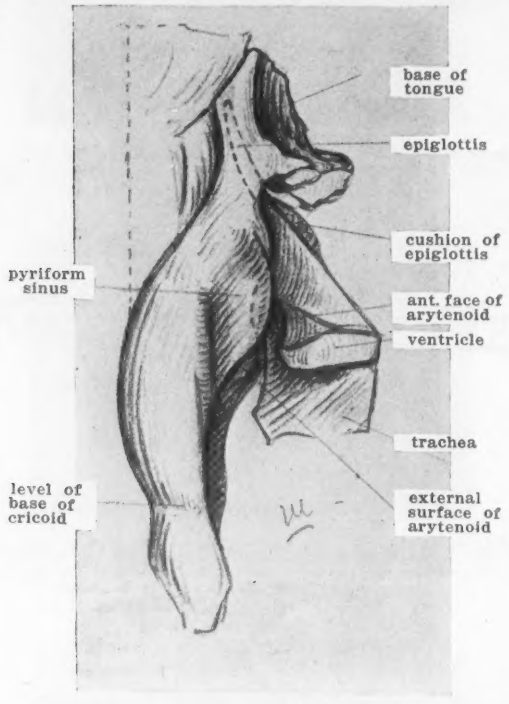


Fig. 17. Drawing of a wax cast of the lower pharynx and of the larynx. Side view. The dotted lines indicate where the cast is deficient. It was the study of this cast which gave the anatomical interpretation of the X-ray tracing of the esophageal pouch shown in Fig. No. 18. Natural size.

against the weak spot of the esophagus. The pyriform sinuses do the same thing. If we didn't have a backbone we all would have an esophageal pouch.

The Formation of an Artificial Pouch: This year I made my first artificial pouch on the cadaver. I was struck with the ease with which it can be done. The mucous membrane of the esophagus is very easily invaginated through the circular fibres of the

esophagus in the weak triangle by the pressure of the finger tip or the end of a knife handle. By pushing the thickened lower edge of the inferior constrictor upward the pouch is readily made larger and larger. In this way a pouch a half to three-quaters of an inch is readily made. The lower edge of the constrictor acts as a constricting band—in fulfillment of its name—about the mouth of the pouch posteriorly and superiorly.

Fig. 18. X-ray tracing of an esophageal pouch. Notice the level at which the esophagus begins. At first glance it looks as if it began in the middle of the anterior wall of the pouch. After studying this point on wax casts and on wet specimens of the larynx and lower pharynx, it became clear that the opening of the esophagus was on a level with the top of the cricoid cartilage, and that the ascending, slightly curved oblique line above the opening of the esophagus was the outline of the pyriform sinus. The posterior rim of the mouth of the pouch is much higher than the level of the anterior rim. That is, it is roughly on a level with the top of the arytenoids. In this instance, owing to the higher level of the posterior rim of the mouth of the pouch, the pouch tends to stay wide open. Notice the difference in the antro-posterior width of the mouth of the pouch and the mouth of the esophagus. The esophagus is reduced to a narrow ribbon until it passes the bottom of the pouch. The esophagus is squeezed between the pouch and the cricoid cartilage. As soon as these two structures release it, it increases in size. As the mouth of the esophagus begins at the bottom of the cricoid cartilage and, as the level of the weak triangle is at this level also, the pouch in this instance is a hernia through the lower fibres of the inferior constrictor. Reduced one-half.

The drag of the pouch closes the esophageal opening to a small round central lumen or to a short transverse slit. On reducing the pouch the esophageal opening resumes its natural shape.

I have never understood why resecting an esophageal pouch at once restored the lumen of the esophagus. Neither could I under-

stand why the opening of the pouch was always large and the opening of the esophagus narrow. If one will make an artificial pouch he will see how these things happen. (See Fig. 15.)

X-ray Findings: In looking over my X-ray plates of esophageal pouches I was fortunate enough to find two in which the lower pharynx as well as the pouch were shown. Most of the plates give only the pouch so that one cannot judge where the pouch leaves the pharynx. In order to check up these two plates I filled a wet specimen of the pharynx and the larynx with barium, and also made a wax cast of such a specimen. By comparing the X-rays of the two pouches with the X-ray of the barium filled pharynx and the wax

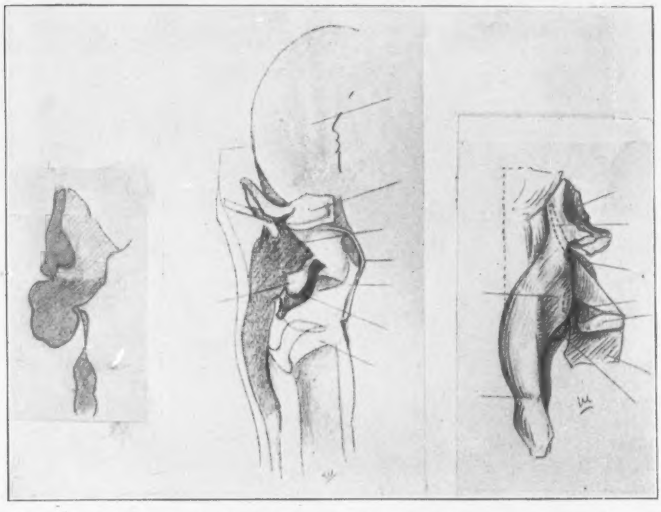


Fig. 19. Figs. No. 16, 17 and 18 grouped in order to visualize the anatomical relationships of an esophageal pouch.

cast of the pharynx and the vestibule of the larynx I was able to orientate myself in the interpretation of the X-rays of the pouches.

The first point which came out in this study was that the level of the mouth of the two pouches was at the top of the cricoid cartilage. The weak spot in the posterior wall of the esophagus begins at the lower edge of the cricoid cartilage. Therefore, in these two instances, at least, the hernia broke through the inferior constrictor nearly an inch above its lower border and did not break through the weak triangle of the posterior esophageal wall. From this observation I have the feeling that the hernia can break through either the

constrictor or the weak triangle of the esophagus. (See Figs. 16, 17, 18, 19.)

The pouch empties by overflowing when it is full. The slit between the front wall of the pouch and the posterior surface of the

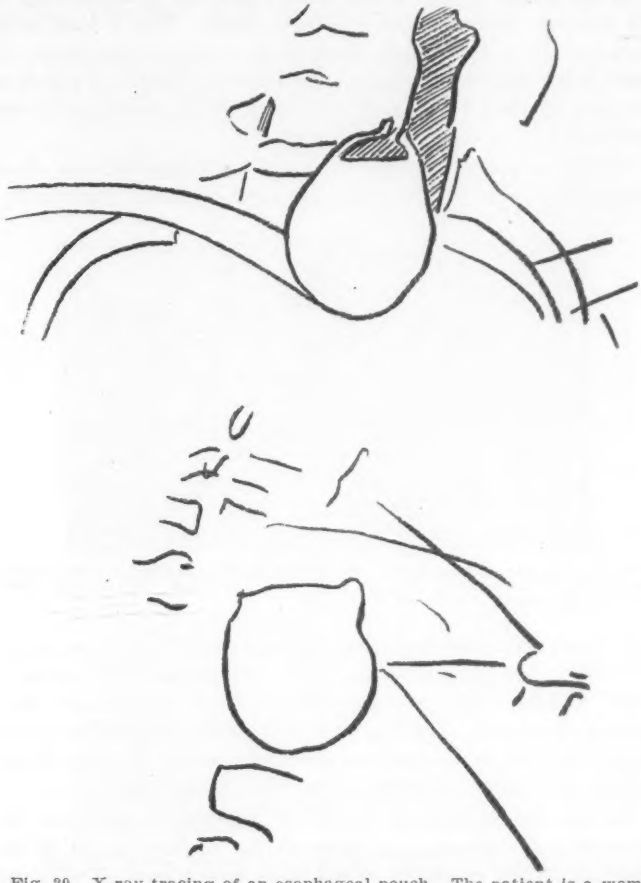


Fig. 20. X-ray tracing of an esophageal pouch. The patient is a woman 76 years of age. The upper drawing is a lateral view. The neck of the pouch appears to be pedunculated. The lower drawing is from an antro-posterior plate. Notice that the width of the mouth of the pouch takes the whole of the transverse diameter of the lower pharynx. Reduced one-half. Plate by Dr. G. H. Holmes.

cricoid cartilage is narrow antro-posteriorly so that the stream of barium escaping from the pouch is also narrow antro-posteriorly until the bottom of the cricoid cartilage is passed. Below the cri-

coid the stream at once widens out. Antro-posterior plates show that the width of the mouth of the pouch is the whole width of the lower pharynx at the top of the cricoid cartilage.

In the lateral X-ray of the two pouches the posterior edge of the pharynx shadow shows a distinct notch. This I have interpreted as the posterior upper limit of the mouth of the pouch, the notch being due to the edge of the inferior constrictor muscle at the point of the protrusion of the hernia of the esophageal muscle membrane.

A study of the rest of my X-rays of esophageal pouches shows that pouches occur in two forms, the small beginning pouch with a

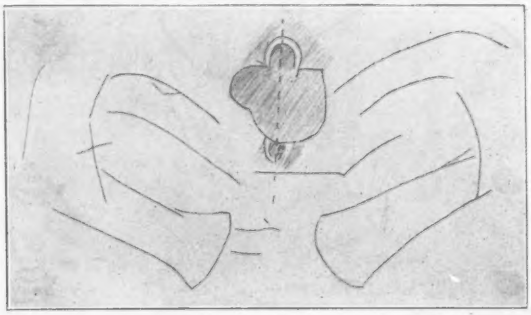


Fig. 21. Tracing of an X-ray of a pouch of the esophagus. The dotted line is drawn through the tips of the spinous processes. Notice the asymmetry of the pouch. Reduced one-half.

wide mouth antro-posteriorly and the pedunculated pouch, the mouth of which is narrow antro-posteriorly. The pedunculated pouch is larger, probably older, and descends lower in the neck, at times entering the thorax. (See Fig. 20.) Still another observation is that the pouches may be asymmetrical when checked up by a line drawn through the spinous processes. (See Figs. 21, 22, 23.)

Through the courtesy of Dr. W. F. Knowles I was given the opportunity of studying the plates of the smallest pouch of the upper end of the esophagus that I have so far seen. The lateral plate of this case clears up one point under discussion and the antro-posterior plate is very suggestive in regard to another. In the lateral plate the pouch is seen to come off the esophagus at the level of the weak triangle of the posteior wall, that is, at the lower edge of the cricoid cartilage. I have only four plates which gave sufficient data for determining the level of the mouth of the pouch. Two left the esophagus at the level of the top of the cricoid car-

tilage and so pierced the lower part of the inferior constrictor, and two came off at the lower border of the cricoid cartilage and herniated through the weak triangle of the posterior wall of the esophagus. (See Figs. 18, 25, 26.)

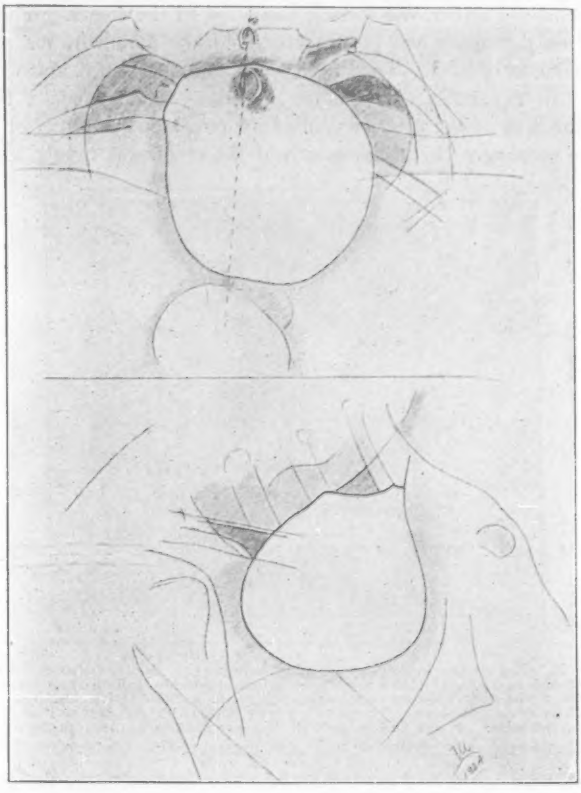


Fig. 22. X-ray tracing of a very large pouch. The bottom of the pouch almost touches the arch of the aorta. In the antro-posterior plate both the vertical and the transverse diameter measure nearly three inches. The dotted line is drawn through the spinous processes of the vertebrae. This shows that the pouch is asymmetrical. This cannot be due to pressure because the lower drawing which is a tracing from the lateral plate shows that the pouch is free in the thoracic cavity. There is a marked forward curve of the spine. Owing to this there is plenty of room for the pouch between the spine and the sternum. Reduced one-half.

The point which the lateral plate clears up is the mechanism of the formation of the notch in the posterior pharyngeal wall just above the pouch. In this film the inferior constrictor is quite a distance in front of the spine, because the pharynx is not full. If

the pharynx were full of barium it is easy to see that the constrictor would be forced back against the vertebrae, and that the backward folding of the muscle would make a gap between the lower edge of the constrictor and the upper rim of the mouth of the pouch. Further, the forcing backward of the constrictor would draw on the upper and posterior edge of the mouth of the pouch and tend to open it. Thus it happens that the pouch always fills first. In experimenting with the artificially made pouch I found that the drag of the anterior wall of the pouch on the posterior wall of the esophagus closed the mouth of the esophagus tightly against

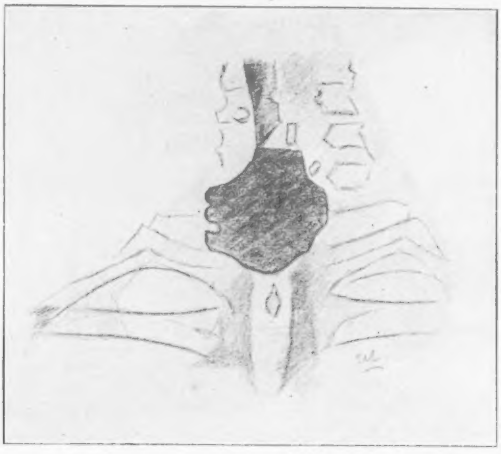


Fig. 23. X-ray tracing of an esophageal pouch. A line drawn through the spinous processes of the vertebrae shows that the pouch is asymmetrical. Only the left half of the lower pharynx is filled with barium. The esophagus does not show. There is no way, therefore, of determining from the film whether or not the mouth of the esophagus is asymmetrical.

the posterior surface of the cricoid cartilage, and the more the pouch was forced downward the tighter the mouth of the esophagus was closed.

The antro-posterior plate is even more suggestive. It shows that the lateral width of the esophagus is very small and that the esophagus leaves the pouch at one side—the left—and then swings sharply to the middle line. I like to interpret this plate as follows because this interpretation fits in so well with my theory: the mouth of the esophagus is asymmetrical, the right half being glued up. (See Fig. 13.) In my specimens of asymmetry of the mouth of the esophagus it was the right half also which was closed. The

unequal strain produced by the asymmetry in this case is the probable cause of the formation of the pouch.

Owing to the age of this patient and to the fact that the small pouch causes so little inconvenience it has not been deemed advisable to make an examination with the esophagoscope. What is necessary, of course, to test my theory is accurate observations on pouch cases made through the esophagoscope with the theory of asymmetry in mind. I have not had a pouch case to examine since I began these observations. The future will tell whether this is fortunate for me, or not.

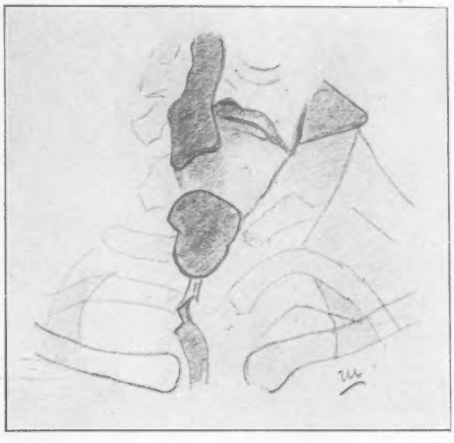


Fig. 24. X-ray tracing of an esophageal pouch. The larynx is asymmetrical and tipped to the left. Only the right half of the lower pharynx is filled with barium. The esophagus is seen centrally placed at the bottom of the pouch. The illustration is given to show asymmetry of the larynx associated with an esophageal pouch. Reduced one-half.

After reading this paper in St. Louis before the American Bronchoscopic Society I went to Denver to take part in the post-graduate instruction given by the Colorado Society of Ophthalmology and Otolaryngology. A congress of the State Society of Ophthalmology and Otolaryngology followed the post-graduate course and this paper was my offering for the program. A few days before the congress was to be held Dr. C. E. Cooper, of Denver, asked me to see a patient of his who had a pouch of the upper end of the esophagus. The man was in the forties and had had trouble with swallowing for four years. The symptoms were not severe. He could eat everything but from time to time food would stick or after eating, food would be regurgitated. On lying down he would cough and

strangle because of food and fluid coming back into his mouth. The patient's trouble began after an attack of smallpox four years previously. No other etiological factor could be obtained from the history.

The fluoroscopic examination by Dr. Crosby showed that the pouch emptied freely and that the mouth of the esophagus came off at the left. (See Fig. 27 and compare with Fig. 25.) The examination of the patient under ether showed that the mouth of the esophagus was asymmetrical, that the opening was on the left, the right half being obliterated. The opening of the esophagus was easily

Fig. 25. Retouched tracing from an X-ray film of a small esophageal pouch. Notice that the esophagus does not run down in line with the center of the pouch but from the left side. The supposition is that the right half of the mouth of the esophagus is obliterated. Owing to the age of the patient and because the pouch gave only slight symptoms no esophageal examination was advised. Compare with Figs. No. 13 and 27. Reduced one-half.

found and it was easy also to pass into the esophagus a No. 30 F. elastic bougie.

Here then was the case which I had hoped for and the findings which I needed to show that asymmetry of the esophagus can be associated with an esophageal pouch. The case completes the chain of proof which I have tried to build up. For this reason and for many others, social, scenic, and scientific, this Denver trip was a banner one.

Post-Cricoid Narrowing of the Esophagus: Not only X-rays of pouches of the esophagus but plates taken of normal swallowing show that the stream of barium is narrowed as it passes the posterior

surface of the cricoid cartilage. Median antro-posterior sections of the head and neck show that the front surface of the bodies of the fifth and sixth cervical vertebrae are markedly hollowed out and that in some cases the upper edge of the cricoid cartilage fits into one or the other of these notches, in others the lower edge of

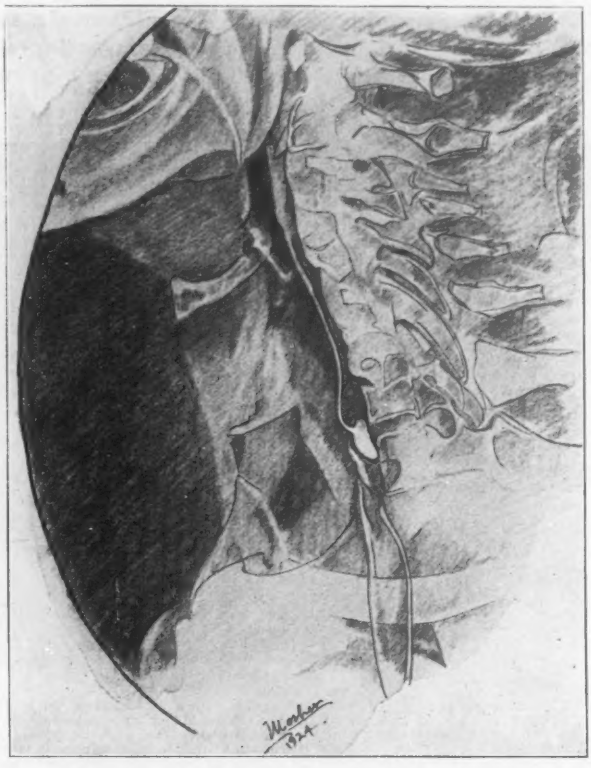


Fig. 26. Retouched X-ray tracing. This film is the lateral view of the small pouch shown in Fig. No. 25. The upper limit of the pouch is at the bottom of the body of the seventh cervical vertebra. The opening of the esophagus is at the top of the pouch. Notice how the esophagus widens as soon as it escapes from between the pouch behind and the cricoid cartilage in front. This post-cricoid narrowing of the esophagus is characteristic of pouch cases. Notice the laxity of the pharyngeal wall just above the pouch. Reduced one-half.

the cartilage fits the notch opposite it. It looks as if the backward pressure of the cricoid cartilage had worn these notches, because the other cervical vertebrae do not show them. When the cartilage is pressed back into one of these notches it makes a complete stopper

for the mouth of the esophagus. The presence of such a notch with the cricoid fitting into it would be an added reason for difficulty in engaging a bougie or a tube in the mouth of the esophagus. Also it would be a reason for overstrain in the lower pharynx in swallowing. (See Fig. 28.)

The Role of Asymmetry in the Formation of Esophageal Pouches: If the lower pharyngeal funnel is distorted or asymmetrical the muscle strain in swallowing is thrown off center and the more curved

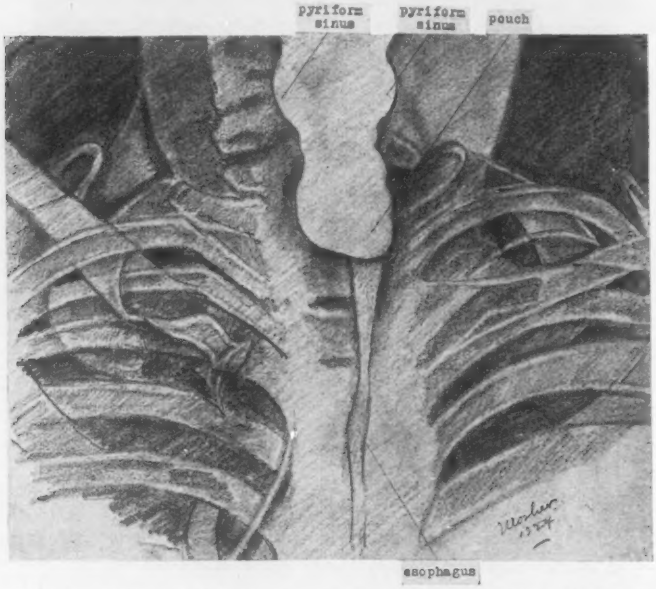


Fig. 27. X-ray tracing of an esophageal pouch associated with asymmetry of the mouth of the esophagus. Notice that the esophagus runs down on the left side of the pouch. On examining the patient under ether it was found that the right half of the mouth of the esophagus was obliterated. Compare with Figs. No. 13-25. Patient seen through the courtesy of Dr. C. E. Cooper, of Denver. X-ray plate reproduced through the courtesy of Dr. L. G. Crosby, of Denver. Reduced one-half.

side of the pharynx tends to pouch. If one-half of the mouth of the esophagus is obliterated as in the specimens figured in Figs. 13, 27, more food reaches the mouth of the esophagus than it can take care of and again there is unequal strain and a tendency to pouch formation. If a web exists in the pyriform sinus there is already a beginning pouch of the mucous membrane of the lower pharynx. The enlargement of this pouch downward and backward could readily start an esophageal pouch because the downward excursion

of the pouch on the side wall of the esophagus is prevented by the stopper like action of the cricoid cartilage. Therefore this beginning pouch is forced through the posterior pharyngeal wall. According to this theory double pouches if such occur would be due to bilateral webs of the pyriform sinus.

What is the Cause of Asymmetry? It is a natural question to ask what is the cause of the asymmetry described above. Trauma

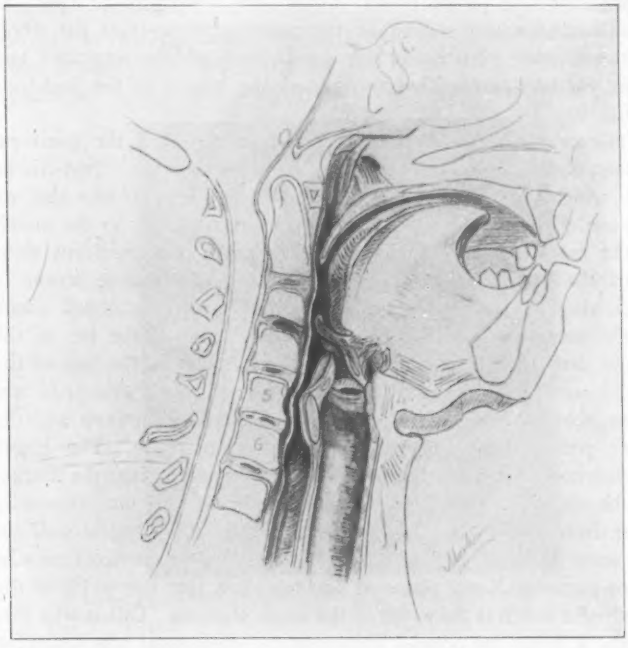


Fig. 28. Drawing from a median antro-posterior section of an adult female cadaver. Notice the notch in the front face of the fifth cervical vertebra. Manipulation of the cricoid cartilage showed that the upper half of the cartilage fitted into this notch and acted like a stopper for the mouth of the esophagus. The writer's feeling is that this notch was worn by the constant pressure of the cricoid. Notice that there is a smaller notch in the sixth vertebra and that the other cervical vertebrae do not show noches. Reduced one-half.

could deform the halves of the thyroid cartilage and so deform the pyriform sinus. Asymmetry of the thyroid cartilage and of the pyriform sinuses is so common in the cadaver that I do not think that trauma is the usual cause of it. Unilateral webs of the pyriform sinuses could easily be the result of a traumatic or infectious ulceration of the mucous membrane of the lower pharynx. Embryol-

ogy teaches that the thyroid cartilage is a late addition and is found only in mammals. The cricoid cartilage and the arytenoids are older and are found wherever a larynx is present. The thyroid is formed from the fourth and fifth arches, the cricoid and the arytenoids from the sixth. This difference in origin could lead to a lack of parallel embryological development. As the arches above occasionally go wrong, the lower one can do the same thing. As we grow older our necks become stiff and our musculature less active. Swallowing in young people is very quick, it is slower in the aged. A dissection of a wet section of the pharynx shows that the fibres of the inferior constrictor are coarse and widely separated and easily forced apart. The strength of the muscle is the backbone behind it.

Summary: Asymmetry of the thyroid cartilage, the pyriform sinuses, and of the mouth of the esophagus is common. Post-cricoid webs which turn one or both pyriform sinuses into pockets also are common. The cricoid cartilage acts as a real stopper to the mouth of the esophagus. A sufficient deformity of the pyriform sinus or of the mouth of the esophagus throws the muscle strain in swallowing off center. A post-cricoid web makes an actual pouch on the lateral wall of the pharynx at the level of the top of the cricoid cartilage. Esophageal pouches may start at the top of the cricoid cartilage or at the bottom. Esophageal pouches occur in two forms, the small pouch with a wide antro-posterior mouth and the larger pouch with a narrow antro-posterior mouth. The larger pouches appear to be pedunculated and often extend into the thorax. The hernia of the esophageal mucous membrane does not necessarily occur through the weak triangle of the posterior esophageal wall but may occur through the lower part of the inferior constrictor muscle. Antro-posterior X-ray plates of pouches show that the width of the mouth of a pouch is the width of the lower pharynx. This is why it is so easy to enter the pouch. Experimental esophageal pouches show that the drag of the pouch narrows the mouth of the esophagus to a slit, closely applied to the posterior surface of the cricoid cartilage. The reduction of the pouch or its ablation at once restores the lumen of the esophagus to its natural size.

828 Beacon Street.

A FOREIGN BODY IN THE BRONCHUS OF NINE YEARS' DURATION.*

DR. W. LIKELY SIMPSON, Memphis, Tenn.

R. E. E., Jr., age 11 years, came May 5, 1923, with the following history:

When 2 years old, inhaled a tack; had an attack of coughing, choking, etc., but soon became almost normal, and was allowed to go for a long time without a searching examination. Has had many colds, especially of the lungs. For the last three years the symptoms, such as purulent expectoration, cough and

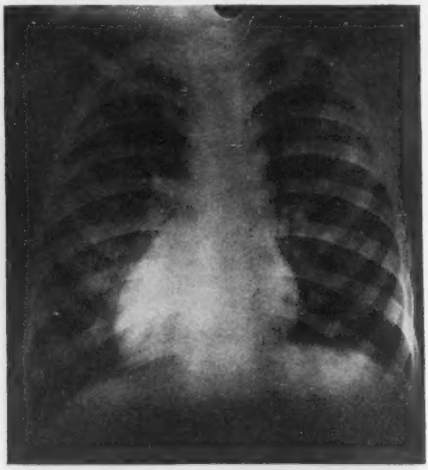
Roentgenogram of chest before foreign body was removed.

slight loss in weight, have been more noticeable. The last five or six months has been sick almost all of the time. Four months ago had what was diagnosed as "a stubborn case of pneumonia", and was very ill. A few months ago, the condition was diagnosed as tuberculosis, but at no time were bacilli found. Three days ago, following a jump from a high chair, had a severe pain in the right side of chest, which has continued and is worse during movements of body.

May 5, 1923: Examination: Emaciated boy, temperature 103°, profuse purulent expectoration and cough and pain in

*Read before the American Bronchoscopic Society, St. Louis, May 28, 1924.

right side of chest. Diminished expansion and dullness on percussion in right lower lobe. Practically no voice or breath sounds. A Roentgenogram was made, and foreign body was located well down in right bronchus, and a well developed obstruction pneumonia in right lower lobe. Ether was given, and a tack (see specimen) was found, head down, surrounded by pus and granulation, and with very little difficulty was removed. The temperature was of a septic type, for only three days, and then dropped to normal, and has been normal



Roentgenogram one year after foreign body was removed.

since that time, which is a trifle more than one year. It was suggested to the parents that this little patient be treated as if he had tuberculosis, but the boy has been so well that practically no treatment has been carried out.

The second Roentgenogram was made a few days ago, showing how completely the lung has cleared up.

Exchange Bldg.

OBSERVATIONS ON THE TECHNIQUE OF BRONCHOSCOPY FOR DISEASES OF THE LUNG.*

DR. WILLIAM F. MOORE and DR. R. M. LUKENS, Philadelphia, Pa

1. Selection and Preparation of Patient: The preliminary study of these cases is of the utmost importance and dependent in great part for its success upon the physical examination by the internist, the careful interpretation by the roentgenologist, and a study of the bronchial secretions by the bacteriologist. No one of these can be omitted; the physical and X-ray findings determine the extent of the lesion more exactly than can be accomplished by the bronchoscope. Furthermore, it is of the greatest help to the bronchoscopist if these studies are made by colleagues who are particularly interested in and have had frequent opportunities of observing this class of cases. The examination by the bacteriologist is very necessary, first, because he may thus determine the specific infecting organism and, second, in preparing an autogenous vaccine for future use.

It is also of the utmost practical importance in the preparation of these patients that their confidence be secured, as no small part of the end result of treatment depends upon the co-operation of the patient.

No general anesthetic is used, nor have we thought that it might be useful, in any way, in patients bronchoscoped in this clinic. In treating adults a preliminary hypodermatic injection of a quarter grain of morphine is routinely used one hour before the bronchoscopy, but even this can be dispensed with in the majority of cases after the first two or three treatments.

Immediately before the bronchoscopy a 10 per cent solution of cocain is applied to the laryngo-pharynx deep enough to inhibit the superior laryngeal nerve. Two applications are usually necessary.

In children under twelve years of age cocain is never used. Morphine, as in adults, is given (in doses suitable to their ages), but here too can readily be dispensed with after the first two or three bronchoscopies.

2. Armentaria: It is, possibly, superfluous to call your attention to the fact that these cases should never be bronchoscoped without a full equipment of tools, ready at hand.

Time will not admit of this subject being gone into in detail, but it is well to bear in mind that emergencies do arise which necessitate the readiness of a tracheotomy set. This should always be at hand and ready for use. These cases are at times complicated by foreign bodies or neoplasms. The equipment, therefore, should

*Read before the American Bronchoscopic Society, St. Louis, May 28, 1924.

include, also, instruments designed to accomplish this work. Bronchial dilators will be found indispensible.

Hemoptysis may be controlled by packing off one bronchus with the pack devised by Dr. Jackson. It is well to have these ready for such an emergency.

Bismuth subnitrate is a good haemostatic when insufflated through the bronchoscope into the bleeding area.

3. Forms of Treatment: Our constant endeavor in any form of treatment used has been to secure the best possible drainage of the affected area. The value of one form of medicament over others used has been by no means established clearly in our minds.

Our usual routine has been to make first a preliminary diagnostic bronchoscopy. At this time the condition of the mucous membrane of the tracheo-bronchial tree is noted. The condition of the orifices observed, both on the right and left side and those determined which are exuding secretion. At this time specimens are secured bronchoscopically for laboratory examination. The form of treatment to be carried out at the second bronchoscopy then depends in part upon the reports from the internist, the roentgenologist and the bacteriologist.

At the second bronchoscopy a thorough aspiration of the affected areas is attempted. Granulations about the bronchial orifices are treated by applying, by means of a swab, a 10 per cent solution of silver nitrate. The affected area is then blocked off with the mouth of the bronchoscope inserted into the bronchus, to insure against a flooding of normal, healthy lung tissue and irrigated.

In this irrigation we have used two grains of tri-nitrol phenol, one dram of Lugol's solution in one pint of normal saline solution. When the return flow of this solution through the aspirating bronchoscope becomes clear the irrigation is discontinued. This can be easily ascertained by inserting a glass union between two cut ends of the return flow tube, which is easily observed by the operator.

After the irrigation is discontinued mineral oils or Gomonal, in 20 per cent solution, are instilled while the bronchoscope is still in position in the affected bronchus.

4. Care of Instruments: The bronchoscopist who is assisted by a nurse well trained in the care of instruments is indeed fortunate. If, in addition, a reliable instrument maker is available who will not delay in repairing, the work will run along much more smoothly.

Bronchoscopic instruments of any kind are necessarily long, slender and delicate, and require the most painstaking attention in order that they may be in proper condition when required. The nurse must be carefully instructed in the cleaning and oiling of the

scopes and forceps. Many complications may result from a neglect of this care by the nurse in charge; such as, *1* broken forceps due to rusting and crystallization of the finely tempered steel, which should be avoided by careful inspection and care; *2* clogged aspiration pipes, which could be avoided by attaching them to the suction tube and running clear water through them immediately after use and before boiling; *3* broken or dented bronchoscope, caused by biting by the patient—avoided by careful inspection; *4* moving the clean instrument table when bronchoscoping a suppuration case, or protecting same with a hood so that contamination is avoided; *5* sponges may be lost in the bronchus—avoided by seeing that they are carefully adjusted and tightened in the carrier and that the right size be used. Finally, duplicate instruments should be at hand for every case.

5. After Care: a Postural: These patients are very carefully instructed with relation to posture to facilitate drainage between the weekly treatments, the correct position which we think will facilitate drainage during waking hours being assumed as often as possible, and at night a sleeping position on the sound side is recommended. *b* Vaccines: Vaccines are given to the clinic patients, each reporting to the hospital at four-day intervals. Where the patient has been sent by a physician they are instructed to have these vaccines given at four-day intervals at the physician's office. The vaccines are started with two minims and increased until a maximum dose of twenty minims has been given five times. Fresh vaccines are made at two-month intervals.

6. Bacteriological Examination: The bacteriologist working in conjunction with the bronchoscopist in the Department of Diseases of the Chest at Jefferson Hospital has helped in no small part in the accomplishment of the work. His presence at the time of bronchoscopy in these cases insures an intelligent co-operation and interest which is hard to secure in any other way.

Fresh culture media are constantly on hand and the regions from which cultures or specimens are taken are carefully noted. In each case secretions are taken by swab from the affected area and if the secretion is sufficient and not too viscid special collection tubes attached to the aspirating tube are used. These are sealed at the time of the bronchoscopy.

The bacteriologist is further of the greatest importance in this work in that he transfers the specimens immediately to the laboratory at the proper temperature and without delay. Microscopical, and especially dark field illumination examination, are made on the same day as the bronchoscopy.

Bronchoscopic Clinic, Jefferson Hospital.

COMPARATIVE STUDY OF IVORY AND ORGANIC TRANSPLANTS IN RHINOPLASTY. ENDO-NASAL OPERATIVE TECHNIC OF SOME NASAL DEFORMITIES WITH REPORT OF CASES.

DR. J. MALINIAK, Cincinnati, Ohio.

Constructive surgery on the face with its enormous material obtained on the battle fields of Europe during the late world war has given us some positive conclusions. This branch of surgery, so enriched by this experience will certainly continue to find its application in corrective surgery in times of peace. After the first year of research and trials in the course of the war, methods more or less definite have been worked out, especially in the maxillo-facial departments which have had charge of those wounded in the face. These methods were only an improvement of the old ones, which were imperfect due to lack of experience.

Since these facial deformities could not be masked as those in other parts of the body, an effort was made to correct the deformity at any cost.

To the physical suffering of these wounded was always added the moral one, often more intense than the former. It was due to a feeling of degradation and disgust which this type of patients believed they inspire in others.

This is the reason for the great zeal shown by surgeons in the treatment of facial deformities and the striking results obtained.

Oto-rhino-laryngologists, familiar with the facial structure, have been called upon in Europe to take a large part in this work of reconstruction; Morestin, Lemaître, Sebileau, Joseph, Lexer, Esser and Gillies in Europe, and Davis and Carter and many others in America have enriched our knowledge by numerous treatises and publications.

Morestin, professor of surgery of the faculty of Paris, who died before the end of the war as a result of the tremendous overwork in this field of surgery, has left at the Museum of Val-de-Grace at Paris an imperishable monument to his great genius. You will find there innumerable wax models presenting the most diverse deformities of the face before and after reconstruction. The total and

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partial rhinoplasties, extensive osseus defects with deep adherent cicatrices, hernias of the brain, etc., the whole gamut of deformities of the head can be studied there in different stages of their reconstruction.

Ferdinand Lemaître,[1] oto-rhino-laryngologist of Paris, in his service at Vichy, directed during the war a model facial reconstruction clinic. His work is summed up in numerous publications appearing in the *Revue Maxillo-faciale.*

In the Charite of Berlin, Jacques Joseph during the years of the war, reconstructed facial deformities with an ingenuity which has given him world fame. Here also wax models and numerous publications testify to the work done.[2] Our extended work with this great teacher of facial plastics has shown us how this constructive surgery has, in times of peace, benefited the corrective field of congenital, traumatic and pathological deformities of the face.

We wish to mention also the name of Esser,[3] who by his method of epithelization "epithelium enlaye" has revolutionized plastic surgery. Gillies,[4] who has collected thoroughly a large amount of material on facial surgery in his book on Plastic Surgery of the Face, has shown the importance of systematic work in this field.

The heroic wounded of the war were certainly worthy of the greatest efforts which could be given to them with all the interest and ingenuity of the medical profession. But the victims of heredity, of disease and of accident, though less heroic are not less worthy of our interest and feelings of commiseration. These deformities of the face and especially of the nose have excited surgical interest for a long time.

The corrective interventions were considered by some general surgeons in years prior to the war as unworthy of the surgical profession. The years of the war which have awakened the interest of the profession and the laity in cosmetics of the wounded, have thus educated medical and lay opinion.

All these congenital, traumatic and pathological deformities can and must now be remedied no matter whether it is a question of a total or partial rhinoplasty or a correction of an excess or defect of substance.

These patients are affected in their social life as in their intimate feelings. The humility to which they are subjected or at least think they are, creates a moral and psychical inequilibrium. This psychic depression is almost always present in this type of patients. The most striking mental improvement is always noted after the

correction of these deformities. The patients return ordinarily to life, losing with the relief of their humiliation, all their previous depression and very often their professional status is improved.

It should be understood that only a deformity that is sufficiently noticeable to shock the esthetic feelings should be corrected. The psuedo deformities which are found in super-sensitive people should be remedied simply by persuasion.

COMPARATIVE STUDY OF TRANSPLANTS IN RHINOPLASTY.

This question has been very conscientiously studied in connection with plastic surgery during and after the war.

1. *Bone transplant.* Clinical observations have shown us that the transplantation of bone fragments for correction of deformities of the nose often is followed by an evident absorption which is observed in the thinning of the transplant.

Jacque Joseph[5] since 1918 has preferred to use in appropriate cases of saddle nose, ivory or cartilage prothesis, since they are not absorbed as are bone transplants. Gillies[4] no longer employs bony prothesis for nasal corrections but limits its indications to the reconstruction of loss of bony substance of the malar or mandibular bones.

A good preparation of the bone receptor and a good fixation of the osseous graft are indispensable conditions for the union of the latter. The osseous graft used as prothesis in a saddle nose is in contact with the bone at only one end. This contact with the frontal bones does not have the intimacy of the bone graft in the long bones. Moreover, even in the latter condition, absorption occurs at times even after years, as is demonstrated by radiography.[6]

Sheehan[7] also believes that osseous grafts used for the correction of nasal deformities are absorbed with years.

Carter[8] employs an osteocartilaginous graft from the ribs and insists on the importance of contact of the osseous end of the transplant with the frontal bones. He admits, however, that he has observed absorption of the osseous graft and that the latter is more difficult to manage for correction of deformities than is cartilage. In fact, in establishing a contact of the osseous graft with the frontal bones, the glabella becomes masked and the profile assumes an ancient Greek contour foreign to our modern tastes.

John Staige Davis[9] in a series of very interesting experiments on animals, made a minute comparative study on the evolution of the cartilage and bone transplants in the tissues. He experimented with grafts removed from the tibia (compact bone) and from the ribs (spongy bone) with and without periosteum. While in some

experiments after 223 days the bone was entirely absorbed, in others, the same sort of graft showed traces of its presence after since the time—other experiments showed absorption of grafts of the rib or fibula covered with periosteum. These bony fragments transplanted into the soft tissues have been absorbed a little more rapidly than those in contact with denuded bone.

Thus the experimentation in animals confirms the results of clinical observation. The following conclusions are pertinent:

1. The bony prothesis is difficult to manage and its use in nasal deformities fails often satisfactorily to correct them.

2. With or without periosteum, the osseous graft is absorbed more or less quickly and it is impossible to predict the rate of absorption.

3. It is more fragile than cartilage and more readily infected. Once infected, it is almost always totally eliminated.

II. CARTILAGE TRANSPLANT.

Van Mangoldt[10] in 1897 was the first to use cartilage in autoplasty for closure of the larynx. Nelaton[11] used for the first time rib cartilage in rhinoplasty. J. S. Davis[12] in 1913 in a precise experimental work showed the great vitality of cartilage. In his experiments on fifteen dogs the costal cartilage was transplanted into pedunculated cutaneous pockets in order to have conditions similar to clinical ones. His conclusions may be summed up as follows: "Results obtained in these experiments show that transplantation of cartilage is a safe and promising procedure. It is especially advantageous in the correction of saddle noses. As to the fate of the transplanted cartilage in these experiments as far as can be seen, the cartilage lives and is properly nourished. No increase in length, no absorption, no sign of degeneration either macro- or microscopical."

Microscopically, great changes were not observed, except absorption of the central region of calcification. The cells were for the most part well preserved. This conservation of cartilage cells does not seem to be influenced by the presence or absence of the perichondrium.

Murray[13] made for Professor Keith a histologic study of autologous and homologous cartilage grafts in which the permanence of cartilage was demonstrated.

Gillies[14] believes also that cartilage is without rival for cosmetic purposes.

Our own experiences during and after the war has led us to consider cartilage as a transplant always easy to obtain in sufficient

quantity, easy to model and retaining its size and shape. In patients operated upon for ozena in whom rib cartilage was transplanted under the atrophic and infected nasal mucosa, I observed the stability of this substance even under these abnormal conditions. I will have occasion to present some of these cases in the near future. Attention must be called to the tendency to bend with the perichondrium in its concavity which this transplant presents when covered with perichondrium. This curvature may be utilized to restore the normal contour of the face, such as the orbital arch, the dorsum and wings of the nose, the malar bone, etc. The graft used without periosteum remains straight.

Morestin[14] during the war advocated the use of cartilage. Gosset, Duval, Bazy[14] and Quenu, the most distinguished French names

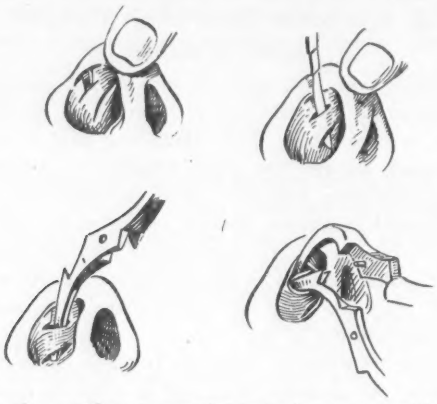

Fig. 1. The alar cartilage is resected in its lower part with the adherent nasal mucosa and submucously in its upper part. A mucous membrane flap is thus made.

in surgery following the publications of Morestin, adopted the use of this transplant in facial plastics with great success.

Source of cartilage. Alar, aricular and costal cartilages are to be considered.

a. The alar cartilages of the nasal tip may furnish small fragments sufficient to correct a slight dorsal depression such as one may observe after a submucous resection of the septum or septal abscess. This resection may be made only when the nasal tip is at the same time wide; then the resection on both sides of a segment of alar cartilage with the adherent nasal mucosa may also have for its effect a correction of the nasal tip. These cartilage segments will be used for the correction after the removal of the adher-

ent mucosa. The submucous resection of the alar cartilage in its upper part prevents the adherence of the wound with the vestibular incision made for separation of the dorsal skin. A blind pocket formation and a resulting local nasal redness are thus avoided (Fig. 1).

b. An oblong fragment of the auricular cartilage is excised on the posterior side of the auricle along its line of insertion together with the skin. The wound is closed at once with several horse hair sutures. A resulting fold of skin from the anterior surface of the auricle if present may be excised and the defect sutured. In case No. 2 a segment was excised from the right auricle in which no trace of deformity followed.

c. The 6th, 7th and 8th costal cartilages are especially to be used. The removal even of three cartilages is unimportant for the patient. Nevertheless, precautions should be taken to avoid local complications as hematoma and perforation of the pleura. Different fragments in size and shape of the costal cartilage are removed, depending upon the defect to be filled. The cartilage is curved toward the perichondrium and this property may be utilized for correction. One avoids dead spaces between the fragments by pressing them together. The septal cartilage should not be used on account of its quick absorption—the peculiar structure of the cartilage which is constituted of yellow elastic tissue explains this condition.

III. ALLOPLASTY. (INORGANIC TRANSPLANTATION.)

The alloplastic transplants have been rejected for a long time. A systematic study of the behavior of transplanted inorganic substances in the tissues, did not exist until war time. Very often when transplant substance is necessary for correction of a defect, the patient refuses to furnish his own cartilage or bone. Also in cases of pronounced defects an insufficiency of organic required material may occur. In similar conditions the necessity of an inorganic prothesis is evident.

In professional soldiers, numerous in the Russian army during the last war, we have often had the opportunity to find bullets in the soft tissues remaining in place for from ten to twenty-five years, that is, since the Japanese and Balkan wars. These soldiers nearly always refused to have these foreign bodies removed, being rather proud of their glorious emblems. In the tissues we found these bullets closely surrounded by a fibrous capsule. We fail to see why some inorganic prothesis thoroughly sterilized should not remain encapsulated permanently in the tissues, as is the case with the bullets sterilized by heat. Between the numerous inorganic protheses

proposed, ivory is certainly the best qualified because of the many qualities which it offers.

Various publications appeared describing also the use of gold prothesis in cranioplasty.[15] Celluloid has been used for a long time by Fraenkel 1890, Eiselberg in 1893, Frey 1893, and Blecker.[16] The concentration in specialized fields during the war permitted an extensive study of this matter and the deduction of positive conclusions.

E. Estor[17] presented in 1917 before the Surgical Society of Paris a report of one hundred cases of cranioplasty with gold protheses. In ninety-six of these patients, the cranial wounds healed entirely

Fig. 2. Radiograph of Case No. 1 one year after ivory transplantation.

without any complications and could be controlled in the majority of cases for over two years. In four other cases the protheses had to be removed for suppuration without presenting any other complications.

A. Fraenkel,[18] Föderl [19] and lately G. Lewis[20] recommend the use of celluloid as transplant with which they claim to have obtained good results.

Ivory. Special attention should be paid to this substance as it approximates the structure of bone, is easily sterilized and is not absorbable. Mauclaire[21] in 1916 presented in the Surgical Society of Paris three patients who had had cranioplasties in which the cranial substance was replaced by a fenestrated plaque of ivory. The plaque was applied directly on the fibrous covering of the brain. The cellular tissue penetrated the plaque from one face to the other through its orifices. Radiography presented at the same time showed the plaque in place, although not united with the bone.

Jacques Joseph[22] has used ivory protheses since 1918 in the correction of saddle noses with pronounced deformity and in selected cases of total rhinoplasty. During our work in Joseph's Clinic for one and one-half years, I have watched ivory protheses remaining in place for a number of years without any local trouble. I have never observed any kind of reaction, immediate or late, in the surrounding tissues. It generally remained in place without showing absorption, at least in the cases which I have attended during the past five years. It remains slightly mobile on the bony foundation, but without any displacement because the prothesis is very quickly surrounded by a fibrous capsule. The latter is always clearly visible in the X-ray. The successive radiographs show the different stages of encapsulation as is evident in the X-ray films (Fig. 2).

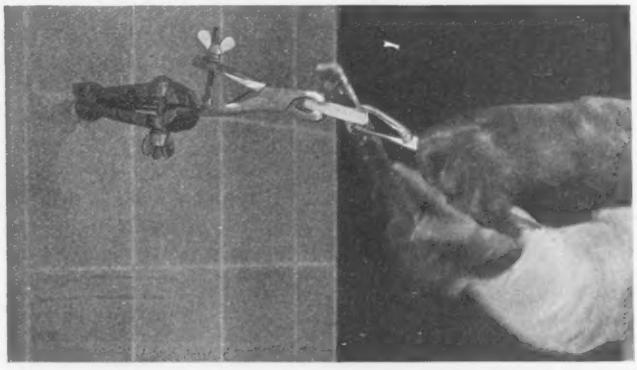

Fig. 3. A sterile metal vice adjusted to another vice fixed permanently in the wall, fixes the ivory prothesis during the operation.

Its use is especially indicated in pronounced deformities where a large amount of substance is necessary to correct the defect of the dorsum and the lateral sides of the nasal pyramid. This last point is extremely important as very often with other organic or inorganic transplants in pronounced defects, this formation of the lateral walls is incomplete. The prothesis is preferably done from a plaster model of the nose. Some orifices made in the lateral sides of the prothesis assures a greater fixation in place as in passing through these orifices, the subcutaneous tissues envelop it more intimately. During the operation retouches may be necessary. As it is difficult to manipulate by hand, the ivory prothesis can be fixed during the operation in a sterile metal vice adjusted itself to an-

other vice fixed permanently in the wall. This prevents its falling on the ground as well as aids in its manipulations. (Fig. 3.) A series of rasps, toothed forceps and saws are placed on a separate sterilized table during the operation.

Avoiding for the patient an extended resection of cartilage, the ivory presents also the advantage of a more perfect correction. Its encapsulation permits in case of necessity the extraction in toto by the endonasal route without any injury to the tissues. This is not always the case with certain organic (bone) or inorganic (paraffin) protheses in which by infection there very often occurs suppuration and modification in the surrounding tissues. We have not seen, however, during the last five years at the clinic of Joseph

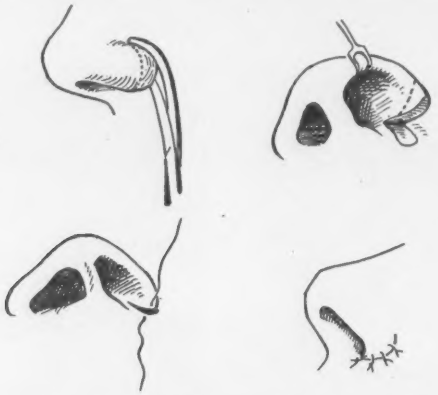

Fig. 4. Correction of exuberant (negroid) wings by excision of correspondent fibro-cutaneous fragments.

and in our own cases, a single case with spontaneous extrusion of the prothesis nor one requiring its removal.

Conclusions in relation to alloplasty:

1. The ivory prothesis, having a structure similar to bone, is indicated for the correction of saddle nose and some forms of total rhinoplasty.

2. It is easy to procure and on account of its consistency it permits a complete reconstruction of the shape.

3. It is easy to sterilize and is not absorbable.

4. The objection of the patient to providing the autoplastic transplant is one of the principal indications. Also a large nasal defect necessitating for its correction a great amount of material, will be preferably done with ivory.

Fig. 5. Case No. 1. Saddle nose before correction. (1)

Fig. 5. Case No. 1. Saddle nose after correction. (2)

Fig. 6. Case No. 2. Before correction. Case No. 2. After correction.

5. The negative results of implantation are without any inconvenience for the patient, the ivory being eliminated entirely endonasally from the fibrous capsule without reaction of the neighboring tissue.

6. Other inorganic substances (celluloid and gold) were used during the war especially for cranioplasty (gold) and as nasal protheses (celluloid). Even in tissues cicatricized after war wounds, these inorganic substances have remained in place. Their presence could be controlled for years. It is therefore probable that the results will remain satisfactory with some of them in the correction of deformities in peace time.

We shall describe at present our technic for the correction of some nasal deformities, such as saddle nose and short nose, applied on patients whose photographs and casts I present, together with some of my patients who have been kind enough to appear here this evening. I will present also a series of photographs and casts of other corrected deformities, but without entering here into the details of technic.

General considerations. Asepsis is one of the conditions for final success in all plastic operations, especially when the question of the use of transplants is involved. The regions near the mouth and nose are rich in blood vessels and lymphatics and disseminate infection easily when a bacterial flora foreign to the region is present. The face should be carefully washed with soap and water, alcohol and bichlorid of mercury. The hair of the nasal vestibule is cut and the region cleansed with corrosive sublimate and covered with tincture of iodin. The mouth is covered with a large gauze pad, soaked in physiological salt solution, which is changed frequently during the operation.

Local anesthesia consists in infiltration with 1 per cent novocain and adrenalin 1-1000 (2 drops to 1 c.c.). General anesthesia should be rarely administered. It compromises the asepsis of the region, makes the operation more bloody and thus introduces an element of danger. If indicated, ether is to be preferred to avoid postoperative hemorrhage due to chloroform (from increase in blood pressure). Free local anesthesia diminishes the vitality of the tissues and modifies the conformation of the nose, rendering more difficult the calculation of the modeling. We make therefore injections of novocain in small amounts in the same place.

Hemorrhage is avoided by separating the skin and periosteum with a blunt periosteal elevator. While the operator prepares the prothesis the assistant presses upon the nasal dorsum thus stopping


Fig. 7. Case No. 3. Before correction. Case No. 3. After correction.


Fig. 8. Case No. 4. Before correction. Case No. 4. After correction.


Fig. 9. Case No. 5. Before correction. Case No. 5. After correction.

the bleeding. Formation of a hematoma impairs the taking of the transplant and it is especially to be avoided in the case of ivory prothesis.

The skin sutures are made with horse hair or with fine silk. Bronze-aluminum wire is very advantageously used in long incisions of the face, the scars being then scarcely seen. The sutured wound is dusted with boric acid and in regions possibly septic, with calomel, which dries, avoiding maceration. The calomel decomposes, forming corrosive sublimate which has a bacteriocidal action. The compressive dressing is maintained with a copper splint for seven days, which favors hemostasis in the beginning, and maintains in place the prothesis. The skin is cleansed every two days and the splint reapplied.

TECHNIC OF CORRECTION OF SADDLE NOSE.

Classification: There are two groups of cases to consider.

1. *Congenital.*

a. Non-syphilitic.

b. Syphilitic.

2. *Acquired.*

a. Traumatic.

b. As a result of a septum operation.

c. After septal abscess.

d. After gumma involving especially the vomer and nasal bones.

e. After nasal lupus, localized in the septal cartilage with collapse of the segment corresponding to the dorsum.

f. Ozena with flat nasal bones irregularly thickened.

g. As an intermediary stage in the correction of a nose arrested in its development. A dorsal depression follows the displacement of a dorsal flap, lowered to form the nasal tip.

The endonasal route is employed by us in the correction of almost all nasal deformities. It is the natural route, giving the most direct and ready access for the nasal bones and cartilages.

Some surgeons advocate the use of the external route, which should be the exception. Joseph[23] used the external route for correction of the nasal deformities until 1904. Since then, it has been unanimously rejected in Europe as Joseph has elaborated the endonasal technic for cosmetic rhinoplasty

Sheehan[24] states that the intranasal routes in plastic surgery are thoroughly non-surgical and should be condemned to the lumber room of surgery with the external routes having the pride of place today. If we followed this author, all our modern endonasal technic used in rhinology for ethmoidectomy, operations on the frontal, sphenoid

and maxillary sinuses, submucus resection of the septum, etc., would be condemned. It is to be noted that general surgeons are not used to the endonasal route, preferring the external. It is explicable but does not diminish the value of the endonasal rhinological operation.

The external incision made on the columella for the introduction of a transplant in saddle nose or for the removal of a hump was first described by Monks in 1898.[25] He made an incision under the nasal tip at the anterior end of the columella. Blunt scissors were engaged in this orifice and by opening and closing them successively a tunnel was formed between the skin and the osteo-cartilaginous dorsum.

J. D. Lewis makes the incision of Monks a little more posteriorly on the columella itself, through which he introduces celluloid for correction of the dorsal defect.

Gillies makes an incision in the vestibulum on each side of the columella at the junction of the skin and mucous membrane; another transverse incision is made at the philtrum. Thus all the columella is lifted and gives sufficient space to introduce the prothesis. By the same procedure he corrects other nasal deformities.

Sheehan, like Monks, makes an incision of the columella spreading it from its centrum to the philtrum. He exposes the anterior part of the septum, separating the mucosa on both sides.

With the majority of rhinologists of Europe, as Joseph, Esser, Lemaître, Laurence, Halle and others, we use under normal conditions the endonasal route for the correction of all nasal deformities.

The introduction of the transplant by the external route is indicated in some particular cases, to-wit:

1. Infection of the nasal fossae or sinuses.

2. The presence of cicatrices of the nasal mucosa after unsuccessful previous operations and prolonged suppurations when the closure of the new incision per primam may be doubtful.

3. In case of the use of ivory.

External incision. 1. *The inner third of the eyebrow* is an ideal place, leaving an invisible scar. The subcutaneous tunnel of the dorsum is made with the scissors by opening and closing them successively. This incision is especially indicated for the introduction of an ivory prothesis where aseptic precautions must be particularly minute. The sutures are placed at a distance from the prothesis and all cause of infection is thus avoided.

2. A transverse fold often present at the root of the nose masks the incision in this place.

3. The alo-labial fold may be utilized to introduce a prothesis after total cutaneous rhinoplasty. In these cases the alo-labial fold presents a scar resulting from the previous modeling of the alae and the lateral part of the nose. An incision through the same scar can be utilized for introduction of the transplant.

Endonasal incision. The endonasal route is used in non-infected nasal fossae for introduction of cartilage in correction of saddle noses and all other nasal deformities. The incision is made under the inferior border of the triangular cartilage. Through this incision, which must not be too large, the periosteum with the soft parts is separated from the underlying bone and cartilage, only to the extent that is to be occupied by the transplant. This separation is made carefully with a special periosteal elevator to avoid hemorrhage and resulting hematoma. Above, the subcutaneous sac reaches the glabella, and the inferior cul-de-sac of the nasal tip must be very deep to assure a good fixation of the inferior end of the transplant. Otherwise, the displacement of the anterior end of the prothesis in the nasal fossa is to be feared. The dissection of the anterior cul-de-sac is best done with a comma-shaped knife of Joseph, which adapts itself readily to the cartilages of the tip. Before placing the transplant, it is advisable to compress the nasal dorsum for some minutes to obtain complete hemostasis. The edges of the endonasal wound are held open by the valves of a medium Killian speculum. The transplant is introduced under the skin of the dorsum without contact with the nasal mucosa.

The wound is sutured with catgut, which we avoid touching with the fingers, tying it by means of anatomical forceps.

The compressive dressing by means of a copper splint padded with gauze will avoid hemorrhage and resulting hematoma; it will also hold the prothesis in place. The nasal tampons should be removed at the end of the second day and the copper splint retained for a week.

Aside from the dorsum, the nasal tip and the alae of a saddle nose almost always require a correction. (Figs. 1, 4.) This is very often neglected as one may judge from descriptions of different authors as well as from the definite results in the patients. In associations with the saddle nose, these deformities of the lower part of the nose appear most often as an elevation of the tip, a bulging of the alar cartilages, exuberance of the wings (negroid) or flattening of the tip (flat nose). All these deformities may also exist separately or in association with other deformities than saddle nose.

CORRECTION OF A SHORT NOSE ARRESTED IN ITS DEVELOPMENT.

This is a congenital deformity characterized by a shortening of the nasal dorsum, making the inferior surface of the nasal tip lie on a higher level than the wings. Normally these conditions are reversed. The nasal openings in this deformity approach the frontal plane and are thus more visible. The upper lip being less covered seems to bulge more. Frequently in a nose arrested in its development other abnormal features are to be noticed, as when the nares are irregularly narrowed by subcutaneous thickenings; the same can be found on the upper lip on both sides of the median line. The bony part of the nose is generally flat.

I present here such a typical case with photographs and casts. This deformity is very often wrongly interpreted and its correction attempted by placing a cartilaginous transplant under the skin of the dorsum. By doing so the height of the nasal dorsum is increased, but the shortness remains uncorrected. We insist upon this point because this fault is commonly met with.

Technic. The nasal tip is formed by dissecting from the skin of the dorsum a reversed V-shaped flap. The superior parts of the incisions are sutured and the flap sufficiently dissected at its base and on the side to form a pocket representing the future tip. This flap is sutured on the sides in a much lower position. The two lateral incisions leave cicatrices, very little visible, but this borrowing of the dorsal skin causes a depression. Since a cartilaginous prothesis is necessary to form a support for the new tip, it will simultaneously correct the depression. This transplant is introduced some weeks after the tip formation. The exaggerated width of the nose, often present, will be corrected at the same time by infraction of the frontal process of the maxillae endonasally. The thickening of the edges of the nasal orifices is corrected by subcutaneous excision of the fibrous tissue. This technic has been employed in Case No. 2, which presented a typical short and flat nose with deformity of the alae and upper lip.

I will now present a typical case for each deformity the technic of which has been described above. I also present some patients operated on for other deformities, the technic of which cannot be described at this time. In other cases the lantern slides and casts will enable you to judge of the results.

Case 1 (Fig. 5): Miss C. G., age 24, presented a pronounced saddle nose with bulged and protruded tip. The nasal bones were flat and wide, negroid wings. Above the glabella a thickening was present due to a piece of bone remaining after a previously unsuccessful bone

transplantation with extrusion of the prothesis. (Fig. 3.) This first operation was performed in July, 1920, and two weeks later the transplant was spontaneously extruded. The patient was suspected of lues, although her Wassermann was negative. Anti-specific treatment was instituted in 1920-1921. In 1923 her Wassermann was again negative. In August of the same year under local anesthesia a previously prepared ivory transplant was introduced by me through an external incision located in the region of the glabella. This place was chosen as the patient presented a natural fold in this region and through the same incision the bony bulging above the glabella could be leveled. The subcutaneous tunnel was carefully dissected to avoid perforation of the nasal mucous membrane and a deep anterior cul-de-sac formed. The negroid wings were properly modeled by excision of triangular fragments. (Fig. 4.) The thinning of the nasal tip could not be performed at the time of the operation for fear of exposing the transplanted ivory. This little intervention was supposed to be performed later on. Being entirely satisfied with the obtained result the patient refused further intervention.

No reaction of the skin or nasal mucous membrane has been noticed at any time, although the dorsal soft tissue was injured by the previous operation and the patient suspected of lues. The ivory continues to have the same shape and size, and the correction of the nasal deformity for one year remains unchanged.

The radiographs of the nose have been taken within an interval of six months to show the position of the ivory and the reaction of the surrounding tissue. On both you see the formation of a fibrous capsule previously referred to which surrounds the ivory and is noticeably more pronounced on the second radiograph. (Fig. 2.)

Case 2 (Fig. 6): Miss H. R., age 20, presented a small nose arrested in its development with flatness of the bony part. The nasal bones were irregularly shaped, due to subcutaneous thickening of the vestibulum with the columella deviated to the left. There was also a subcutaneous thickening of the upper lip on both sides of the median line. The patient is very small for her age. Mental depression was present.

On June 20, 1923, under local anesthesia, lowering of the nasal tip was affected by formation of a reversed V-shaped dorsal flap carefully dissected and sutured in a lowered position. Modeling of the nares by subcutaneous excision of fibrous tissue from the vestibulum and the upper lip was performed. The bony width was narrowed by bilateral infraction of the frontal processes of the maxillae.

Under local anesthesia, excision of an oval-shaped segment of cartilage from the right auricle was made. The transplant was appropriately shaped and introduced under the skin of the dorsum through the incision in the left vestibulum, thus increasing the height of the nose and giving a support to the tip. The condition after operation can be seen in her photograph and cast which show noticeable improvement. As a result of pressure of the slight dorsal scar on the cartilage, a slight groove persisted above the tip. The patient insited upon having the height of the nose more pronounced and the same was done later by transplantation of a cartilage prothesis from the seventh rib.

At present the lowered tip of the nose makes the upper lip look less pronounced. The height and width of the nose are normal, likewise the contour of the nares.

Case 3 (Fig. 7): S. H., age 30. The patient presented a long nose with a moderate sized nasal hump and a pronounced potato bulging of the tip. On Sept. 5, 1923, operation was performed under local anesthesia. There was a subcutaneous removal of the hump with a saw, shortening of the septum and lateral walls by excision of fragments from the quadrangular and alar cartilages of the septum and from the lateral triangular cartilages. Orthopedical suture of the septum was done in order to lift the tip.

Case 4 (Fig. 8): Miss P.D., age 20. The patient presents a pronounced hump nose with exaggerated length of the septum and nasal walls, and a convex columella. Operation under local anesthesia was performed Feb. 29, 1924. Denudation of the bony and cartilaginous dorsum through an incision in both vestibula. Removal of the hump with a saw and modeling with rasps.. Excision of a concave-shaped fragment from the quadrangular and alar cartilages and lifting of the tip by an orthopedical suture. The lateral nasal walls were shortened by an excision of fragments from the triangular cartilages on each side.

Case 5 (Fig. 9): Mrs. F. W., age 30, presents a very pronounced dorsal hump with lowering of the tip and a convex columella. Operation was done under local anesthesia on Mar. 27, 1924. Removal of the hump and shortening of the nasal walls and septum as in Case No. 4. The lifting of the tip necessitated special care because of the very short upper lip.

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Groton Building.

THYMUS CASES.

DR. HARRIS P. MOSHER, Boston.

Following a thymic death a year ago of a child who had been etherized and was about to have his tonsils and adenoids removed, it was made a routine at the Throat Department of the Massachusetts General Hospital and the Massachusetts Eye and Ear Infirmary to radiograph all children from one to fourteen years of age who were booked for the tonsil and adenoid operation. All children showing a broad superior mediastinum were considered as suspicious thymic cases and were given four X-ray treatments of a third of an erythema dose. The treatments were repeated at intervals of ten days.

Total number of children radiographed, 2,344. Of these, 185 or 7.5 per cent, showed a positive thymus shadow. Of the 185 positive cases, 110 have been treated and successfully operated upon. Ninety per cent of the children treated showed a diminution of the broadness of the superior mediastinum.

A BROADER APPROACH TO UNSOLVED PROBLEMS IN LARYNGEAL ACTION.*

DR. ELMER L. KENYON, Chicago.

When one approaches the subject of the dependence of vocal cord action on any manner of muscular activity excepting intrinsic, he treads on physiologic soil that has been but lightly and crudely cultivated. The extraordinary complexities of anatomy, relationship and movement in the extrinsic regions of laryngeal action will undoubtedly be in need of continued exploration for years to come. Two facts stand out clearly: First, that physiologic action of the vocal cords is absolutely impossible without the combined and cooperating action of both intrinsic and extrinsic muscular systems; and, second, that, since Garcia in 1855 taught laryngologists to look into the living larynx, where they imagined they saw only the results of intrinsic action, they have been practically indifferent to the extrinsic side of laryngeal activity.

It might have been better if the words "intrinsic" and "extrinsic" had never been coined; better if the development of knowledge of laryngeal physiology had been carried on from the beginning with the larger and truer conception that involved all, and not merely a part, of the talking function. At any rate the evidence is slowly but definitely accumulating that indicates the inadequacy of the old narrow intrinsic picture to satisfy even the practical point of view of the laryngologist.

The purposes of this essay are, first, to attempt to point out certain broad principles bearing on the relationship of the extrinsic musculature to vocal cord action; second, to suggest the need of further developing the new manner of diagnosis with reference to the extrinsic musculature; and third, to attempt to stimulate laryngologists as a whole to give diagnostic consideration to the extrinsic musculature.

For the persistent indifference through more than two generations of so extraordinary a physiologic activity reasons must exist. In the beginning the study of the interior of the larynx was highly absorbing. And as time went on the continued intrinsic study of laryngeal problems proved to be to a very large degree satisfying. By this time everybody had settled into the general rut of almost exclusively intrinsic study. Then the more fascinating problems

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of surgery came into vogue in laryngology, and there we still remain.

In spite of all this neglect, however, the truth continues to stand, i. e., that no physiologic adductive action of the vocal cords is possible excepting through the combined action of both intrinsic and extrinsic systems of muscles. ..This means that no merely intrinsic study of the larynx can possibly fully explain either the physiologic action of the larynx, or all disturbances in such action.

The vital reason for the contentment of the laryngologist in exclusively intrinsic studies of vocal cord action undoubtedly lies in the fact that such a large percentage, especially of the more marked disorders in the action of the vocal cords, are definitely and exclusively intrinsic problems.

At this stage in our knowledge of the effects on vocal cord action of the extrinsic muscles one must speak with great caution, especially as to details. The physiologic purpose and plan of this more complicated musculature is much harder to understand than that of the intrinsic, in part because the extrinsic muscular action is involved complexly in other functions. Not only is this system of muscles closely concerned with the movements of the vocal cords, but it is also intimately concerned with the act of swallowing and of protection of the larynx from invasion by foreign bodies; it is involved deeply in the mechanism of articulation; it invades the musculature of nasal voice production, and markedly influences vocal resonance in other ways.

Without attempting to enter into full discussion of the activities of the extrinsic musculature at this time, one may best approach a general presentation of the subject negatively, by discussing first of all some things that the extrinsic muscles cannot do. In view of the fact that the extrinsic musculature has no direct attachment to the arytenoid cartilages, it is clear that all larger movements of the vocal cords in both adduction and abduction must, at any rate very largely, be produced by, and determined by, the intrinsic musculature. And, of course, abduction entire is undoubtedly so produced. Therefore, all disturbances of abduction completely, and all larger disturbances of adduction, at any rate, to a very great degree, are undoubtedly intrinsic problems.

Monolateral disturbance in the action of the vocal cords is dependent on the fact that each vocal cord is related exclusively to its own arytenoid cartilage, and that each arytenoid, as well as each vocal cord, is provided with its own exclusive musculature. Since the insertions in the larynx of the extrinsic muscles are not into the arytenoids, disturbance in extrinsic action cannot be ap-

plied exclusively to either cord. Monolateral disturbance in extrinsic muscular action might, to be sure, affect one cord more than another, but it could not affect one cord to the exclusion of the other. Therefore, definite monolateral disturbances in the action of the vocal cords must, in their larger aspects, be intrinsic in origin. In their finer aspects they might be dependent on the extrinsic musculature, but not wholly to the exclusion of disturbance in the other cord. To state the matter briefly, exclusively monolateral disfunction of the vocal cords cannot be caused by disturbance in the extrinsic musculature alone, but might be influenced by such disfunction.

Summing up this negative aspect of extrinsic activity it appears, first, that abduction is not influenced at all by the extrinsic musculature; second, that adduction, either monolateral or bilateral, is in its main aspects definitely an intrinsically produced activity; and, third, that the extrinsic musculature has no capability of confining its activity to one vocal cord to the entire exclusion of the other.

Approaching now directly the effect of the action of the extrinsic musculature on vocal cord action, one may broadly visualize this activity as a great, intelligent, beneficient influence, which enters into the grosser adductive action of the intrinsic muscles to aid them in the accomplishment of their purposes; enters into the finer aspects of their movements, to co-operate more definitely and directly with the intrinsic muscles, in order to assure the full success of the action of the vocal cords for all needs of the voice; and, finally, serves to bring the vocal cord activity into intelligent co-operative relationship with the co-related functions of articulation and resonance. The extrinsic musculature takes, as it were, the larynx and the intrinsic muscles into its great friendly embrace, as if to say, "Now I shall hold you steadily and firmly and apply aid where you need it, that your activities may not be crude and rough and half intelligent, but fine and delicate and co-operative, and thus fully adequate to accomplish the great purpose of talking."

By the lower and middle constrictor muscles, the laryngeal box, both as a whole, and in respect to the hyoid bone, and thyroid and cricoid cartilages individually, is adjusted and steadied for speech purposes against the spinal column. The thyro-hyoid, the sterno-thyroid, and sterno-hyoid, the hyoglossus and many other co-operating extrinsic muscles join in with the action of the intrinsic crico-thryoids to produce the proper adjustment between the thyroid and cricoid cartilages, and thus to determine the ease of action of the arytenoids in closing the vocal cords; and, also, to determine the distance between their origin and insertion. The latter action in-

fluences, first, variation in tension of the vocal cords for pitch-producing purposes, and, second, the details of action of the thyro-arytenoids on which the thickness and manner of vibration of the vocal cords depends.

The intrinsic muscles acting alone would, in all probability, be quite unable to produce that delicacy and perfection of adjustment of the vocal cords required for simple speech purposes, not to mention the finer and more exact and more various details of tension and action required for musical needs.

So far, then, as the vocal cords are directly concerned, the extrinsic musculature seems to be a valuable co-operating force in facilitating the larger adductive movements, and to be a necessary and determinative co-operating factor with respect to all finer adjustments of the vocal cords.

When, therefore, the larger adductive movements of the vocal are not actually inhibited, but become indefinite, or peculiar, from causes that are not clearly intrinsic, or when the finer adjustments of the cords are disturbed from causes that appear indefinite, or uncertain, some origin other than intrinsic, operating presumably through the extrinsic system, is to be suspected. Clinically, such conditions are represented by unusual, especially chronic and bilateral, adductive irregularity, or over action of the vocal cords, and by all manner of disturbance in their finer adjustments. The finer clinical disturbances range all the way from marked bowing of the cords, and chronic conditions of over tension, gradually on into that vague but important and interesting field of phonasthenia. The underlying conditions on which vocal nodes depend are often here to be found, as well as other disorders of the singing voice. The chronic over action disorders of the vocal cords, immediately dependent on persistent over-tension of certain parts of the extrinsic musculature also are to be found here. These are dysphonia spastica the falsetto voice of puberty, the high tension voice of neurasthenia and allied conditions, and certain unusual phases of stammering. Laryngismus stridulous should be studied from this standpoint. And, finally, hysterical aphonia, and its allied disturbances belong in this group.

In order to appreciate more fully the bearing of the extrinsic musculature on vocal cord acticity, certain general facts with reference to voice production should be recalled. Through the action of the extrinsic muscles, the laryngeal box, as a whole, is, as has been intimated, steadied with reference to the spinal column, and is for each particular effort of speech adjusted and held in its required relationship to the base of the tongue and adjoining struc-

tures, preliminary to the finer adjustments between the cricoid and thyroid cartilages and the swinging of the arytenoids on the cricoids for vocal cord approximation. In view of this fact, it is evident that any disturbance of the central physiological controls of speech must, as it were, exhibit such disturbance *through* the extrinsic musculature to the intrinsic. Therefore, tendencies to disturbances in this central control of a functional character must affect the extrinsic as well as the intrinsic musculature.

The speaking function demands of the larynx two principles of action, one for the production of the whispered, and the other for the production of the loud sounds of speech. The essential difference in the action of the vocal cords in this respect lies in the fact that for the loud sounds the vocal bands are definitely tensed and adjusted for the production of the exact vibrations required by the particular sound. And, each muscle, intrinsic and extrinsic, is drawn to the definite degree of tension required for that particular vocal effort. On the other hand for whispered sounds this elaborate muscular definiteness of action dwindles, as it were, into relatively indefinite, flaccid, looseness of action, with however, apparently the entire intrinsic and extrinsic masculature acting in harmony, although without the same exactness, and with certain variations from their action for the loud voice. Nothing in physiology is more striking than the marked alteration of these elaborate systems of muscles as they pass so quietly, and so instantaneously to and from the definiteness and intensity of action for the loud voice to the elaborateness but looseness of action for the whispered voice.

If one were to speculate, he would imagine a certain manner of primary stimulation of presumably the motor word cerebral center, that sets into activity the musculature of speech to produce the loud voice, and another manner of stimulation of the same center to produce the whispered voice. Since in disturbed innervation of the larynx, due to central causes, for example, hysteria, stimulation for the loud voice is susceptible to loss much more commonly and readily than that for the whispered voice, we may presume the stimulation for the loud voice to be more complicated, or difficult, of production. At any rate, disturbance of central stimulation for the loud voice is clinically much more likely to occur than that for the whispered voice. This failure of function for the loud voice would affect equally, of course, both intrinsic and extrinsic systems of muscles, and is seen typically expressed in hysterical aphonia.

Another general consideration of importance in attempting to throw light on unsolved disorders of laryngeal movement is the fact that certain parts of the extrinsic musculature are under immediate, although partial, control of the will, other than for voice production, or swallowing, or laryngeal protection. The volitional control of the extrinsic musculature is largely limited physiologically in accordance with the requirements of pitch production and articulation. But the musculature that suspends the larynx to the lower jaw and involves it so intimately into the structure of the root of the tongue, and which is immediately attached to the hyoid bone, is especially subject, under certain nervous disturbances, to volitional or pseudo-volitional tensions that interfere with normal vocal cord action. Such conditions occur certainly in the falsetto voice of puberty, in dysphonia spastica, in the tense neurasthenic voice, at times in stammering, and probably also in a variety of finer vocal cord disturbances, some of them not yet definitely identified.

Another consideration of importance concerning the general musculature of vocal cord action is the responsiveness with which the complex extrinsic musculature adjusts itself to intrinsic disorders of vocal cord movement. When, for example, one vocal cord becomes completely paralyzed, not only does the intrinsic musculature compensate by over-action of the functioning cord, but the extrinsic musculature apparently experiences no embarrassment in action, but, on the other hand, may be presumed to co-operatte in this compensatory function. Likewise when, through such causes as laryngitis, the vocal cords, by reason of swelling, or other local organic muscular disturbance, fail for a considerable period of time to exactly approximate for the loud voice, this ready responsiveness of the extrinsic musculature to intrinsic disturbances apparently tends to bring about a habit of insufficiency of action affecting both systems of muscles, which may continue long after the physical cause of disturbance has disappeared. Thus an originally intrinsic, physically caused, imperfection of vocal cord adjustment may possibly be continued as a functional disorder, probably involving both systems of muscles.

Even as early as 1880, laryngologists became aware of the fact that functional disorders of the larynx concerned almost, if not quite, exclusively, the muscles of adduction. At the present stage of our knowledge we may tentatively presume that all functional disorders in laryngeal action of central origin, concern the purposive act of talking only, cause exclusively disturbances in adduc-

tion, are always bilateral, and involve both intrinsic and extrinsic systems of muscles.

In order to carry forward the acquirement of a further understanding of the vocal cord problems under discussion, it is necessary that what amounts to a new procedure in laryngeal diagnosis shall be further systematically developed. This new procedure consists in the simultaneous study of disturbed activity within the larynx, in connection with disturbed activity in the extrinsic musculature, outside the larynx. And, unless large numbers of laryngologists enter into such study, since the cases in point are for the most part met only occasionally, most of such problems will, as now, be passed over, and progress in their understanding will then be slow.

Up to the present time, during a period of six or more years, the writer has employed a more or less systematic study of the extrinsic musculature on both normally and abnormally acting larynges. He has for this purpose employed only finger palpation. In this manner he has learned to determine, at any rate to a diagnostically practical degree, an abnormally acting extrinsic musculature, in the following three respects: First, to distinguish between extrinsic action for the whispered and for the loud voice. This is a matter of interpreting the general state of intensity of the muscular action occurring, coupled with certain details as to the position of elevation of the thyroid cartilage. Second, the writer has learned to distinguish definitely certain facts concerning the vertical movements of the thyroid cartilage. Normally, the "Adam's Apple" plays a certain up and down movement in talking, varying, to be sure, within limits, in different individuals. Under certain abnormal conditions of laryngeal action, this movement of the thyroid cartilage becomes markedly altered, and tends to steadily maintain itself in an abnormally elevated position. This occurs not alone in certain marked disturbances of the voice, like that of the falsetto voice of puberty, but also, although less definitely, in certain of the bowed conditions of vocal cord action. Third, the writer has learned to differentiate to a diagnostically practical degree between differences in tension in the action of the extrinsic muscles for the loud voice.

In order to work towards a standardized plan of observation, he employs in all cases at any rate two definite series of sounds spoken slowly and distinctly: 1. Counting from one to ten, and 2. repeating the following vowel sounds: e (even), a (apes), ah (are), aw (awed), o (over), oo (oozing). Each test may be employed in both the loud and the whispered voice.

Thus far, these observations have proved of determinative value in diagnosis, and in some cases of marked aid in treatment, in func-

tional aphonia, the falsetto voice of puberty, dysphonia spastica, the tensed neurasthenic voice, certain unusual phases of stammering, and the weakened, or whispered voice related to bowed vocal cords.

Nothing so emphasizes the need for this broader point of view as the literature of laryngeal disorders during the past years. In no instance in the literature, so far as examined, has the writer found any student of unsolved laryngeal problems of movement actively cognizant of the extrinsic musculature. Certain illustrative cases will throw light on the situation.

In 1886, in an essay before this Association, Dr. Franklin H. Hooper[4] propounded the following question: "How many of the recorded cases of bilateral paralysis of the posterior crico-arytenoid muscles were really contractions of the adductors, or perhaps paralysis of both recurrents?" As to the first part of this query, since chronic adduction of the vocal cords, if of functional origin, must have probably involved tonic action of the extrinsic muscles, as well as the intrinsic, important light on the question could have been obtained in any particular case by simple palpation of the extrinsic movements.

For a number of years following its promulgation in 1880,[3] "Semon's Law" was the subject of extended discussion in all countries engaged in the study of laryngology. This law, as will be remembered, affirmed that "In all progressive organic lesions of the centers or trunks of the motor laryngeal nerves, the abductors of the vocal cords succumb much earlier than the adductors." Semon's explanation was that the abductor muscles were more liable to degenerative changes than the adductors.

In a rather extensive reading of the original literature on this subject, the writer has met with no indication that any investigator was conscious of the possible influence upon adduction of the vocal cords, excepting that occurring by way of the intrinsic musculature. And yet, in any matter directly concerning the facility of adduction, *all* the factors capable of influencing such action should, as a matter of course, have been given consideration. It seems highly probable that the favorable influence of the extrinsic musculature on adduction, adding its weight to that of the intrinsic muscles, might be an important factor in determining the truth of Semon's law. One historical exception to this law, presented by Saundby and confirmed by Semon, concerned an extensive carcinoma of the esophagus which invaded the recurrent laryngeal nerves. Contrary to rule the adductors succumbed before the abductors. A plausible explanation of this exception would seem to be the disablement of action of the sterno-thyroid or sterno-hyoid muscles, or both, to such a degree

as to disturb the supportive action of the entire extrinsic musculature to the intrinsic muscles of adduction.

Jonathan Wright[2] in 1889 mentions a case "in which, what was without doubt, hysterical closure of the glottis was so persistent and caused such extreme inspiratory dyspnoea that tracheotomy with artificial respiration for half an hour were necessary to save the patient's life. Lately, after the lapse of six years, I have seen the patient, who wore the tube for many months. She still has occasional attacks of typical hysterical aphonia with an increase in other hysterical manifestations, but she has had no return of the nearly fatal dyspnoea." This extraordinary diagnosis of marked and long continued bilateral adduction of the vocal cords of unproven cause, could have been confirmed, or disproven by simple examination to determine whether the extrinsic musculature was or was not in tonic activity. Adduction affecting the intrinsic muscles alone, and also abduction, due to hysteria, seems almost incredible. Another tentative explanation would be paresis of the abductors from an unknown organic cause, producing continuous approximation of the vocal cords in the median line, and superinducing a state of hysteria. After the physical cause for the paresis had, under this supposition, disappeared, the hysteria could have continued. At any rate, intelligent study of the extrinsic musculature would have thrown valuable light on this case.

In 1895, Merrick[1] reported a case of acute laryngitis in which the patient had for a long period talked only with a whispered voice. Under treatment the laryngitis disappeared. Since, however, the aphonia did not then cease, but continued for months, the diagnosis of "hysterical aphonia" was gradually arrived at. An intelligent examination of the extrinsic musculature would have demonstrated even on the first visit that the central cerebral innervation for the loud voice was not operating, and that, therefore, the case was one in which acute laryngitis was associated with, or had superinduced, functional aphonia. The aphonia could thus have been demonstrated at once as a mental complication of the laryngitis.

In 1886 to 1889, Semon and Horsley undertook their classical experiments on animals to determine the cerebral representation of laryngeal movements. Previous to their investigations, Broca had already demonstrated the existence of a center in the cortex in man, destruction of which, by disease, eliminated the memory through which spoken words were produced, the so-called kinesthetic, or motor word center. And Krause had already elicited a barking sound by stimulating the corresponding center in the dog.

The investigations of Semon and Horsley were undertaken apparently without realization of the definite effect of the extrinsic musculature on vocal cord action. Their experiments were made during the very years when detailed study of the significance of the extrinsic musculature was being carried on.

These authors set out with the preconceived idea that the volitional act of adduction (for phonation), which to them apparently signified action alone of the intrinsic laryngeal muscles, should be represented in the higher brain centers of the cortex, while the respiratory act of abduction, should be represented rather in the lower motor centers.

During the progress of the experiments, which consisted in electrically stimulating certain definite areas in the brain while, through an artificial opening, the vocal cords were under observation, movements of the throat and mouth muscles were commonly observed associated with those of adduction of the vocal cords, but not always. They concluded that "there is a focus of representation of the vocal cords which is independent of movements of the pharynx." All observed peripheral movements resulting from monolateral central stimulation were bilateral.

It is far from the author's desire or purpose to minimize the importance of, or to criticize these basally important observations. Nevertheless, in view of the lack of definite realization on the part of the observers of the importance of the extrinsic musculature in its relation to intrinsic movements of the larynx, one must feel that the existence of a cortical representation exclusively for the intrinsic musculature can hardly be considered as having been proven by these experiments. Indeed, a cortical representation of the combined extrinsic and intrinsic musculatures would have more exactly realized Semon and Horsley's original pre-experimental conception of volitional cortical representation, and very likely might have, at any rate in a certain manner, been demonstrated by these very experiments, if the observers had been on the lookout for it. One should realize that each muscle engaged in the act of talking must have a nerve representation in some manner with the motor word center, and this would mean representation of each intrinsic and extrinsic muscle. And one may well imagine that these muscle representations in the cortex might theoretically be electrically stimulated either singly or in groups, dependent on the fineness and exact point of application, of the electrode, coupled with the strength of the current.

The above examples from the literature are taken almost at random, and could undoubtedly be multiplied indefinitely.

SUMMARY AND CONCLUSIONS.

1. The intrinsic musculature of the larynx possesses physiologically no power of adductive action independent of the extrinsic musculature.

2. The extrinsic musculature is an important factor in facilitating adductive action of the vocal cords in general, and especially in determining their finer adductive adjustments.

3. Knowledge has been already accumulated that demonstrates the importance of the extrinsic musculature in certain disturbances of vocal cord action.

4. Solution of certain unsolved problems in disturbed laryngeal action depends largely on the simultaneous study of laryngologists, intrinsically of vocal cord action, and extrinsically, of the action of the extrinsic musculature, as a routine procedure.

5. The action of the extrinsic musculature has thus far been studied by the author by finger palpation.

6. The value of a generally broader point of view in the study of certain laryngeal problems is illustrated by examples drawn from the literature of laryngology.

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104 South Michigan Blvd.

COMMUNICATION.

We note in your June issue on page 464, in the article headed "Self-Retaining Direct Laryngoscope. Dr. Rodman", that you say in the second paragraph:

"This instrument is known as the Hasslinger Directoscope, an invention of Dr. Hasslinger of Dr. Hajek's Clinic of Vienna."

Kindly note that this statement does not correspond to the facts and that Seiffert's Direct Autoscope is an independent new invention by Dr. Seiffert of Killian's Clinic in Berlin and is absolutely different from Hasslinger's Directoscope. The Seiffert's Direct Autoscope is made exclusively by Pfau's American Instrument Company and any further information as regards details, etc., will be gladly furnished upon request. PFAU'S AMERICAN INSTRUMENT CO.

CASE REPORTS: SINUSITIS, SERIOUS TYPES.

DR. G. B. TRIBLE, Washington, D. C.

The following cases are all fatalities. Each and every one represented types and conditions met with in oto-laryngology, essentially unfavorable.

Phases in these cases taxed the resources of Roentgenology, general surgery, and internal medicine and illustrate the essential inter-relationship of the branches of medicine. It is believed that by a study of these case reports, with a known termination, in one case an autopsy, more can be gained than by a routine consideration of simple uncomplicated conditions, whose after course may be conjectural.

Case 1: Pan-sinusitis, cerebral abscess from dental infection.

The history, sequence of symptoms and result of the case given below have been so striking and disastrous in conclusion that it is presented with a view of pointing out the innate seriousness of such infections and the possible results.

B. T., male, clerk, age 25 to 28, referred from Dr. Meade, exodontist, this city.

Chief complaint when first seen: dull aching pain over right cheek gradually extending over right side of face and around both eyes. Right cheek swollen, swelling of orbital tissue both above and below globe.

History: Family and past personal history negative so far as present condition concerned.

Dental history: On Apr. 6, had prophylactic dental treatment and immediately following noticed a dull throbbing pain, upper second molar, right, which had been capped two years before, but which, up to this time, had given no trouble. Pain grew worse and he developed some swelling of the right cheek. Radiographs by Dr. Meade revealed a large area of rarefaction in the alveolar process extending low around this tooth.

May 8, dental extraction, uneventful, followed by relief for several days other than the usual post-operative discomfort. After several days with no cessation but rather an increased discomfort he returned for dental examination and trans-illumination showed cloudiness of the right antrum and both frontal regions. Treatment of the infected tooth socket and antral cavity through the tooth socket was continued for a few days without much result, then patient was referred for intranasal antrum treatment.

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Examination at this time showed temperature of 103°, pulse high, full and bounding, face flushed, right cheek and eye swollen and general feeling of malaise with headache and localized pain over the forehead and right cheek.

Antrum aspirated with needle brought out large quantity of foul smelling pus.

Admitted to the Episcopal Eye, Ear and Throat Hospital for establishment of nasal drainage and radiographs of other sinuses. On admission temperature 102°, rising to 103° at 4 p. m., pulse 90, respiration 20. W.B.C. 10400, polys. 78, small lymph. 20, large lymph. 1, 1.

June 4, pre-turbinal antrum opening, local anesthetic, free escape of pus. Temperature did not drop to normal and eye symptoms continued with increasing swelling in right ethmoid area.

June 7, left eye swollen, left frontal area more tender than right, which is subsiding. Radiograph showed "a very marked opacity of the right antrum and ethmoids and also definite cloudiness of the frontals on both sides. The left somewhat more opaque than the right. It is noted that the frontals are very thin and the appearance is somewhat suggestive of involvement of the bone. The left antrum and ethmoid are also clouded, but have the appearance of being fairly well drained." Immediate drainage of the frontals and ethmoids by extensive operation was advised but consultant was desired, who confirmed the advice and under general anesthetic the left frontal was opened, found full of pus, naso-frontal duct enlarged, ethmoids broken down, external wall friable and not much thicker than an egg shell. The inner wall was intact, somewhat roughened, and the inter-frontal septum perforated low in the sinus. The right frontal was then opened, using the radiographs as a guide, for they showed very sharply, septa in the right sinus, one of which almost completely blocked off the outer angle and which, without a radiograph, would have been easily mistaken for the limit of the sinus. Only a probe could be passed below the sickle edge of the septum into the outer walled off segment. Breaking down all septa to the level of the floor and freely enlarging the perforation in the inter-frontal septum was done, all angles explored, ethmoids curetted, naso-frontal ducts enlarged, gauze strips laid in the wound, protruding from the nose and closure of external wounds. No attempt was made to bridge, owing to the thinness of the bones. Time of operation 45 minutes. Soda bicarbonate and glucose 2 per cent each by Murphy drip, reaction uneventful.

Packing partially removed the next day and completely removed at end of 48 hours. Frontal sinuses and right antrum irrigated

daily with 1 per cent merchurochrome by canula. Left antrum not touched, thought from X-ray to be draining.

On the fifth day after operation temperature normal, patient up the seventh day. Five days after being able to get up and go to the dressing room for treatment, he complained of a slight chill at night and some headache and pain in his right chest.

Careful examination of the wounds negative. W.B.C. negative so far as any unusual involvement was concerned.

May 20, awoke feeling well, had hearty breakfast, was laughing and talking with nurse when suddenly she noticed a queer expression, his lips moved but no speech, and he pointed with his left hand to his right and picked it up.

On examination at 8:30 a. m., evident involvement of speech center, motor paralysis of right hand and forearm were noted. Spinal puncture made by Dr. Hough; report came fluid, clear under pressure, smears negative. Blood culture made, W.B.C. 13000 plus. Under anesthesia through exposure of frontal sinuses, by complete incision throwing both sinuses together, no new pockets found, usual granulation of wound repair. Left antrum explored at this time, full of foul smelling pus.

Neurological examination of Dr. D. D. V. Stuart: May 22, 1922, the patient appeared much clouded mentally, and was inarticulate. Because of his total inability to co-operate, the examination was incomplete and unsatisfactory.

Cranial nerves: Pupils unequal, right larger than left; symmetrical; both reacted promptly to light but reaction in accommodation could not be determined. Fundi clear; no haziness of disc margins, no engorgement, no hemorrhages. *Left* VI nerve paralysis, *right* VII and XII nerve paralysis, no dysphagia. Examination of station, gait, co-ordination, and sensory status was impossible.

Muscle status: Paralysis of right upper extremity, great weakness of right lower extremity. Some retraction of head and rigidity of neck muscles. Suspicion of Kernig's sign on right.

Superficial reflexes: Pharyngeal not obtained; abdominal (upper and lower segments) and cremasteric, active and equal on both sides; plantar stimulation and descending tibial irritation, followed by plantar flexion on both sides.

Deep reflexes: Active and equal on both sides.

Speech: Inarticulate; impossible to determine whether this was due to asphasia or XII nerve paralysis.

Laboratory reports: Blood culture (Dr. J. B. Nichols) negative; spinal fluid (Dr. Wm. H. Hough) increased pressure, protein content triple plus, cells 88 (90 per cent polymorphonuclears), culture

negative. Pulse at time of examination, 93; temperature, 101.6° (mouth).

Impression: Diffuse purulent meningitis or brain abscess (left frontal lobe, perhaps extending backward). While abscess could not be absolutely excluded, the above findings together with the abrupt onset, rapid development of symptoms, scattered cranical nerve involvement, high pulse rate, and spinal fluid report, seemed strongly suggestive of meningitis.

Three days later the patient was again seen. At this time he was stuporous but could be aroused, and the pulse had dropped to 70. There was no change in the findings excepting a distinct clouding of the margins of the left optic disc. The diagnosis of abscess appeared more probable, but not positive.

Being unable to delay attendance at the American Medical Association any longer, Dr. Gill and Dr. Strine kindly took over the management of the case and later made another exploration of the wound and found some roughness and discoloration of the frontal sinus wall, which was sounded, dura exposed and some free pus found. Further operative procedure was considered hopeless and wound was packed, death occurred, laboratory reported, spinal fluid negative.

Post-mortem findings: Brain abscess left temporal and frontal lobes involving nearly the whole hemisphere.

Considerations: This represents a series of events which are possible with any alveolar abscess opening into the antrum. First, an antrum infection, then ethmoid, then frontal sinus, extending to both frontals, then descending ethmoid and antrum infections.

Cerebral involvement may take place by direct extension giving an extradural abscess or meningitis, or, as it is believed in this case, an involvement of the emissary veins or otherwise entrance in the blood stream.

The association of sudden headache, pain in the chest and chill would suggest an invasion of the blood stream, but the negative blood culture would tend to dispel this. No post-mortem examination of other organs was permitted. Possibly a left sub-temporal decompression and exploration of the brain in the area of the speech center would help in some cases. In this case, it was considered, but the diffuse nerve involvement tended to obscure the diagnosis. Had it been done, release of such a quantity of pus would have undoubtedly been followed by death on the table.

The author wishes to acknowledge assistance in the case by Drs. Gill, Strine, Mason, Stuart and Hough, and, especially, to Dr. Morgan, then resident at the Episcopal Eye, Ear and Throat Hospital, who helped throughout and who kept record of this case.

Case 2: E. C., miss, age 24, clerk, first came for examination Apr. 7, 1923, giving a negative family history, negative previous history, physically decidedly below par in weight, general build, and a secondary anemia of considerable extent, hg. Talquist 70. Local condition and history as follows: For the past year she had had colds, nasal discharge and some sore throat, had been under treatment by a specialist, who advised and performed a tonsillectomy, after which her condition was more uncomfortable and, being dissatisfied, she had given up treatment for some months. She had been informed she had frontal sinus trouble, no radiographs had been taken. Rhinoscopic examination showed profuse right nasal discharge, coming from the middle turbinate area, middle turbinate enlarged, bullous type, pus from right antrum on aspiration after puncture. Nasal breathing, right obstructed. Radiograph, Dr. G., Apr. 10, reported, "Examination of the nasal accessory sinuses complete opacity of the right antrum, anterior ethmoids, and right frontal. The other sinuses are clear."

Apr. 14: Ant. end rt. middle turbinate removed to promote drainage, and routine treatment by suction, antrum aspiration, irrigation, and packing by medicated strips instituted. Headache continued and in spite of patient's reluctance, she consented to an antrum operation, and at the same time an intra-nasal ethmoid, right, which was performed in June at the Eye and Ear Hospital. Pus and polypoid degeneration of the lining mucosa were found in the antrum, ethmoid cells broken into, granulation tissue coming away in the curetted material. Immediate post-operative recovery uneventful, nasal discharge much lessened, no further antrum symptoms, dental neuralgia and numbness cleared up, but frontal headache, starting in the right and extending to the left, did not entirely cease. Since she contemplated marriage within a short time and wished no disfiguring operation, and the radiograph showed the frontal sinus to be small on the right side, she was permitted, at her suggestion, to go to the seashore to build up her general health and see if another operation could not be avoided. A temporary improvement and amelioration of symptoms resulted.

Persistent dull headache, unaccounted for by general physical examination, induced her to decide on the frontal, which was done Oct. 28, at the Emergency Hospital sinus found small, filled with granulations and free pus, the type of frontal emphasized in recent literature as being due to infection in childhood, with failure to carry out the normal pneumatization. A rubber catheter was passed through the enlarged frontal-nasal opening and left for 72 hours, irrigation with mercurochrome through the catheter. Immediate post-operative course was uneventful, but the case did not

complete the convalescene. Vague headaches, general feeling of malaise, then more acute discomfort, referred for general physical examination with a view of determining if there were any systemic infection. Nothing was found, but owing to the unsatisfactory home surroundings, it was advised to place her in a nursing home for attention to her diet and general condition. The operative wound cleared, discharge nearly ceased, but a large boss over the frontal bone, above and to the temporal side of the wound, appeared, not very painful, smooth, no fluctuation. Wassermann, plus 1. Mercury by intra-muscular injection begun, but the finding was questioned, and further tests were negative. Irregular temperature, and leucocytosis, with no physical signs or evidence of involvement of the central nervous system were found by the consultant, Dr. Easton. She was advised to return to the hospital for exploratory operative procedure, wished consultation, and consultant felt that exploration of the other side and reopening of wound was indicated. This was done, and nothing found, specimen of bone taken from the infected right side and sent to the laboratory of the hospital for sectioning. Laboratory report came back, "Bone from frontal sinus region. There is definite erosion of the bone with marked infiltration of polymorphonuclear leucocytes. Diagnosis: Osteomyelitis."

Specimen of spinal fluid clear, under slight pressure; laboratory report, negative.

There was no improvement and definite meningeal and cerebral symptoms developed. Upon advice of the internist associated in the case, blood transfusion of 650 c.c., Dec. 7, was done and repeated on the seventh and eighth. Death occurred Dec. 8. Previous eye ground examinations by Dr. Green were negative up to the seventh, when blurring of the discs was noted. No post-mortem was permitted, clinically, either a meningitis, probably serosa, or septicemia, spinal fluid negative on smear and culture, and blood culture negative also.

This type of case, essentially chronic, associated with poor physique, often with bad hygenic surroundings, and prone to osteomyelitis, is of necessity a bad surgical risk. When one considers the bony walls of the sinuses, exposed to infection, protected only by a thin lining of mucosa, connecting with the dural and intracranial circulation by the emissary veins, the marvel is that nature has developed the resistance she has against these universal infections.

Case 3: G. H., male, 52 years of age, secretary; came for examination July 28, 1923, complaining of profuse rightsided nasal dis-

charge, pain on right side of the head, and complete right-sided nasal obstruction.

No family history or previous history of any import. Present trouble commenced about seven weeks before, immediately following dental extraction of some much neglected teeth. Examination showed unhealed tooth sockets, right upper pre-molars and molars, right nares completely obstructed with large masses of polypi, with pus exuding between the masses. Immediate hospitalization urged, temperature 101°, pulse high, radical antrum performed next day, found filled with pus, but the floor presented a firm, irregular mass, giving the feel of deer's horn in the velvet. Section removed for examination. This specimen was unfortunately lost, pain continued, especially over right orbit and side of head and X-ray report gave the following: "X-ray report, Aug. 9, 1923. Examination of the nasal accessory sinuses shows considerable opacity of the right antrum, right ethmoids, and right frontal. The right frontal is considerably smaller than the left. The right antrum is relatively less opaque than the right frontal and ethmoids. No root fragments are noted in the right upper jaw."

The right frontal was opened, free frontal nasal drainage established, and another section removed from the antral floor and sent for a laboratory examination. Report on this specimen was epithelioma. Seventy mil. of radium in a capsule was inserted in the antrum and retained 18 hours under the direction of Dr. Groover. Then intensive X-ray therapy was instituted, with an amelioration of symptoms, except persistent headache, which continued. About five weeks later, there was noted a paresis of the right external rectus and a decided change for the worse, profuse discharge, frightfully offensive odor, intolerable pain, necessitating continuous use of opiates. He became so weak that he finally re-entered the hospital to await the inevitable termination. Three days after admission, he had a profuse hemorrhage from the nose and throat and died in a few minutes. No post-mortem was permitted. *Conclusion:* The error in this case was in not radically removing the upper jaw, for there was, at the time, first seen no glandular involvement. The percentage of mortality immediately following operation is given as about 30 per cent. It is very difficult to suddenly tell a man that such a mutilating operation is necessary, and the tendency is to palliate and use less vigorous measures. It would seem that if there ever was a field favored by anatomy for the use of radium and X-ray, it would be the upper jaw and antrum, where access can be had from all sides.

CYST OF MEDIASTINUM, PROBABLY DERMOID, WITH LEFT LARYNGEAL PARALYSIS.*

DR. HARMON SMITH, New York City.

F. Z., male, 57 years of age, carpenter by trade, was first examined in my clinic at the Manhattan Eye, Ear and Throat Hospital, Feb. 15, 1924, and admitted to the hospital for observation ten days later.

Subjective symptoms: He complained of marked hoarseness, shortness of breath and cough, accompanied with white frothy expectoration and general physical exhaustion.

Past history: He had had a sunstroke while in Cuba during the Spanish-American war, but otherwise his health was good until the date of his present illness.

Present history: About one year ago he fell from a scaffolding while working, and a few days later he became hoarse, which increased rapidly to almost aphonia; this condition still exists. At that time his general health also began to fail and in the last two months he has lost fifteen pounds. A month ago he developed the present cough and raises considerable white frothy mucus but untinged with blood. Marked dyspnea occurs upon the slightest exertion.

Physical examination: Marked emaciation. Some tracheal tugging but not marked. There is an area of dullness on the left side—over the upper lobe of the lung. Temperature is normal. Pulse ranges from 70 to 100 with equal force in both wrists. Respiration varies from 20-30, according to exertion. His blood pressure is 140 and equal on both sides.

Blood examination: Wassermann is negative; white B. C., 8,200; red B. C., 4,080,000; poly's, 76 per cent; S. L., 12 per cent; L. L., 8 per cent; hemoglobin, 75 per cent; trans., 4 per cent.

Urinary analysis: Urea, 56 mgs. per 100 c. c. Otherwise negative.

Sputum examination: Negative for T. B. C.

Laryngoscopic examination: Nothing of import was seen except a fixed left arytenoid and the vocal cord in the cadaveric position, i. e., between the median line and complete abduction, with the tip of the arytenoid tilted forward. The cord was foreshortened and

*Read before the Section of Laryngology and Rhinology at the New York Academy of Medicine, Apr. 23, 1924.

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less red than the active cord—which condition indicates a *complete* recurrent nerve paralysis.

Bronchoscopic examination: Drs. Imperatori and Knopf made a very thorough examination and have kindly submitted their report to me as follows: "Left vocal cord fixed in the cadaveric position. Trachea apparently normal except for an increased amount of

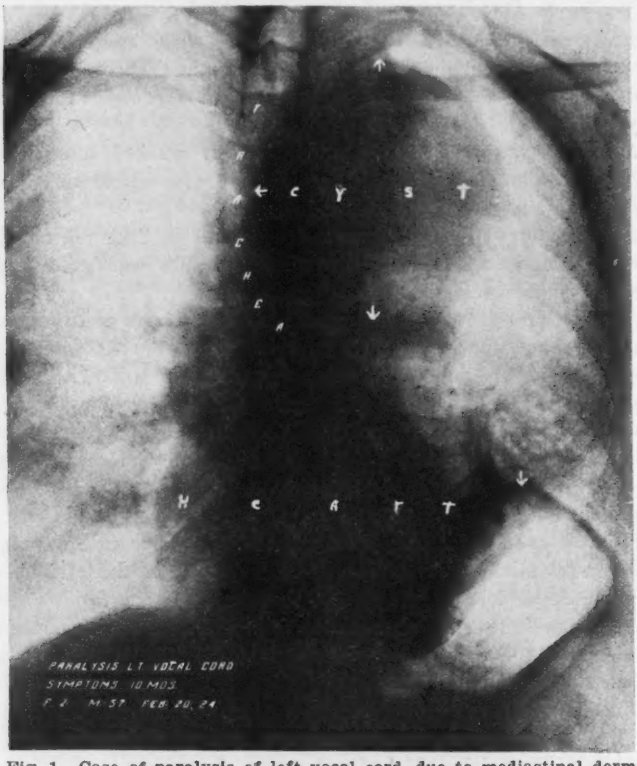


Fig. 1. Case of paralysis of left vocal cord, due to mediastinal dermoid cyst as indicated by four arrows. Note pressure on left bronchus and displacement of trachea to the right. Eventration of diaphragm on left indicated by arrow. (Radiograph by Dr. L. T. LeWald.)

mucus adhering to the walls. Right bronchus entered without difficulty. Left bronchus entered with great difficulty, owing to an almost complete obstruction by a smooth firm mass covered by an unbroken mucosa which was moderately congested and pulsated slightly. The mass gave no evidences of an aneurism as it assumed a firmer resistance, such as a cyst might offer. The pulsations were

synchronous with the heart beat but appeared to be not of the tumor but directed by a contracoup force. Tentative diagnosis: Left recurrent laryngeal paralysis due to pressure on recurrent nerve from a mediastinal growth—probably a cyst.

X-ray examination: Dr. Law first made an X-ray plate of the chest and submitted the opinion that the mediastinal growth was probably an aneurism, but of this he was not certain. Wishing to

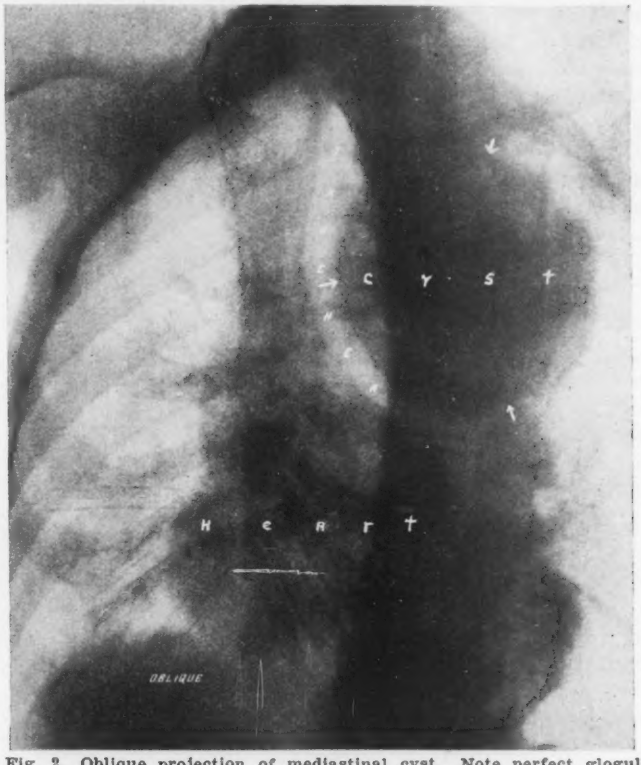


Fig. 2. Oblique projection of mediastinal cyst. Note perfect globular shape. (Radiograph by Dr. L. T. LeWald.)

have another opinion, Dr. Houghton, who made the physical examination, kindly consented to take the patient to Dr. LeWald for a more extensive investigation and examination, which he hoped Dr. LeWald's wider experience in X-raying tumors of the chest would aid in making a diagnosis. The question at issue was what type of mediastinal tumor it might be, for any kind of tumor in

this location could and does often produce laryngeal paralysis. Dr. leWald's report is as follows:

"The X-ray examination was made Feb. 20, 1924. There is a large mediastinal shadow projecting to the left, apparently in contact with the trachea and left bronchus. It measures about 4¾ inches in transverse diameter. It is perfectly regular in contour and globular in shape. It is probable that the paralysis of the left

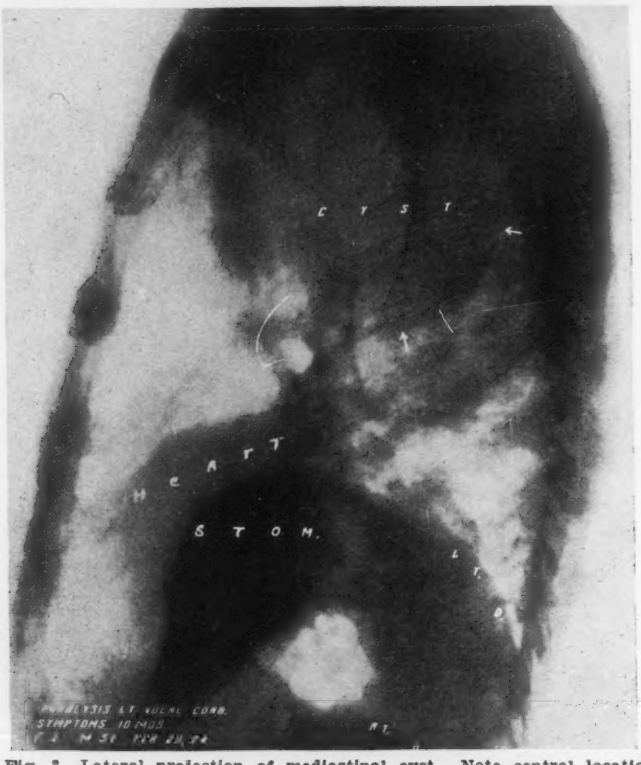


Fig. 3. Lateral projection of mediastinal cyst. Note central location. Also note eventration of diaphragm with stomach in contact with the high left side of diaphragm. (Radiograph by Dr. L. T. LeWald.)

vocal cord is due to pressure from this mass. No pulsation is shown under the fluoroscope except at the inferior border where it approaches the heart and this pulsation is probably transmitted from the heart.

On the lateral exposure it is difficult to completely outline the mass, but as far as can be determined it is located centrally in an

antero-posterior plane above the heart shadow. The shadow is believed to be due to a dermoid cyst, which is increasing in size and its presence is causing pressure.

There is another entirely separate condition present, namely, eventration of the left side of the diaphragm, associated with a very high cardiac pouch of the stomach, which fits into the thinned out diaphragm, which projects upward for a distance of about three inches above the level of the right diaphragm. Part of this space is also occupied by the splenic flexure of the colon. On fluoroscopic examination the opaque substance is seen to enter the abdominal cavity through the usual opening in the diaphragm for the esophagus. In the dorsal position the cardiac end of the stomach is filled, but at no point can any portion of the stomach be made out above the diaphragm. On inspiration the right side of the diaphragm is projected downward while the left side moves slightly upward, giving the paradoxical movement of the diaphragm associated with eventration of the diaphragm found in so-called paralysis of the left half of the diaphragm.

Seventeen hours after the administration of opaque material the head of the column had reached the rectum. Traces remain as far back as the cecum. The splenic flexure is about in the average position. The hepatic flexure is moderately low in position. Reexamination of the stomach still shows somewhat of a cascade appearance, probably produced by eventration of the diaphragm. The left side of the diaphragm is about two inches higher than the right side.

Summary: In view of the extremely regular contour and the absence of definite pulsation, the mediastinal shadow is believed to be due to a cyst and on account of its density, location and similarity to other observed shadows it is believed to be of a dermoid nature. Another measurement by means of a teleroentgenogram should be made after an interval of a few weeks to determine its rate of growth. If pressure symptoms become urgent, thorocotomy may be necessary to give relief, provided that on subsequent examination the question of aneurysm is still further excluded. There is congenital eventration of the diaphragm on the left side."

The patient was kept under observation eleven days in the hospital, and after dismissal was advised to return for subsequent observation and possibly for an operation. In presenting the matter to Dr. Phelps, our consulting surgeon at the hospital, he thought it quite justifiable to attempt removing the growth by opening the chest cavity. The patient, however, went to a hospital in Brooklyn,

where Dr. Knopf finally located him. He is now, to all appearances, sinking rapidly. It will be most interesting to obtain an autopsy and verify if possible, Dr. LeWald's diagnosis. An autopsy has been promised, and if possible the findings will be reported.

Tumor of the mediastinum producing laryngeal paralysis occur in about the following order of frequency: (1) Tubercular glands, (2) syphilomata, (3) Hodgkin's disease, extending from the neck, (4) substernal thyroid and enlarged thymus, (5) lipoma and dermoids, (6) sarcomata, particularly lympho-sarcoma, (7) carcinoma.

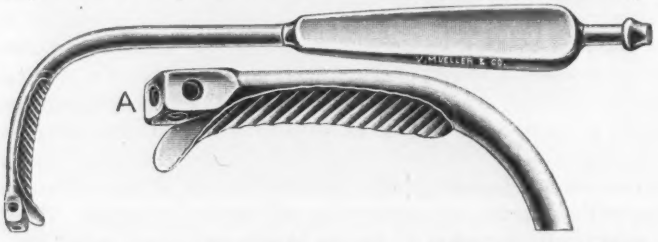
The mediastinal tumors may all result in paralysis of the recurrent laryngeal in accordance with location; paralysis may also result from *pericarditis,* with *dilated left auricle,* complicating mitral stenosis, and *cancer* of the *esophagus.*

44 West 49th St.

COMBINED TONGUE ELEVATOR AND SUCTION.

DR. G. D. AYER, Atlanta, Ga.

A very simple combination tongue elevator and suction combined. Designed so that regardless of position held will always elevate tongue. It is *impossible* with this instrument to crowd *tongue*



downward, insuring free air passage at all times. The handle is sufficiently long so that assistant's hand is out of the way of the operator. Suction is sufficiently large to remove blood clots, etc., from the throat.

826 Hurt Bldg.

Editor's Note: This mss. received in The Laryngoscope office and accepted for publication, June 26, 1924.

NASHVILLE ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY.

June 27, 1924.

The Nashville Academy of Ophthalmology and Oto-Laryngology met at St. Thomas Hospital on Monday, June 16, 1924, with the President, Dr. E. B. Cayce, in the chair. The following cases were brought before the Society:

Ligation of the Internal Jugular Vein. Dr. Robert Sullivan.

Dr. Robert Sullivan reported the case of F. S., female, age 13 years.

Past history: Mother and one sister had pulmonary tuberculosis. Patient was treated eighteen months ago for pulmonary tuberculosis. The diagnosis was positive by physical signs, X-ray, and sputum. She has had recurrent purulent otitis media right ear for several years. January, 1924, had tonsil and adenoid operation.

Present history: Apr. 20, right ear, acute purulent otitis media for two weeks. Nausea and intermittent vomiting.

Examination: Right ear, acute purulent otitis media. Tenderness and swelling over right mastoid, some tenderness over jugular vein. Temperature 104°. Chilly. Advised operation. White blood count 15,000. Blood culture negative.

Treatment: Apr. 21, simple mastoidectomy done with exposure of lateral sinus, which was completely thrombosed. After removing thrombus, from above there was slight oozing of blood; none from below. Internal jugular vein ligated.

Result: Patient remained in hospital two weeks. Mastoid wound closed in twelve days. Patient dismissed at the end of three weeks, cured.

DISCUSSION.

DR. EUGENE ORR arose to congratulate Dr. Sullivan upon the excellent result in this case.

DR. M. M. CULLOM had seen this case frequently with Dr. Sullivan and considers it a matter of considerable interest for such a case to recover. He believes this was what might be called a sterile thrombosis, i. e., next to the circulation. The fact that the blood culture was negative and the temperature no higher shows that the thrombus had not broken down and set up trouble in the circulation.

DR. HILLIARD WOOD is glad Dr. Sullivan ligated the jugular vein. He thinks a great deal of this procedure in thrombosis of the lateral sinus. He does not consider any sinus operation complete without it, as it does a wonderful amount of good.

DR. FRED HASTY considers this report interesting in many respects. It is another demonstration of the variations of the signs, symptoms, laboratory findings, etc., in blood stream infection complicating mastoiditis. The temperature chart if turned upside down is really more suggestive of blood stream infection than it is when read in the ordinary manner; in other words, this patient was evidently unable to respond to the state of toxemia by a rise of temperature. Indeed there was a depression of the normal temperature to a considerable extent. He is glad that Dr.

Sullivan ligated the jugular vein and predicts that as statistics on sinus thrombosis accumulate there will be less hesitancy in ligating the jugular vein in suspected cases of blood stream infection. We now know that prompt and complete surgery offers the best chances for recovery.

DR. W. G. KENNON said that upon a recent visit to Boston he had been very much interested in the frequency with which ligations of the jugular vein were done, in many cases without exploration of the sinus. He did not question the judgment of ligation, but he did question the fact that they were having so many cases of sinus thrombosis, as from 10 to 15 per cent of all their cases had sinus thrombosis according to their ideas.

Lynch Frontal Sinus Operation. Dr. M. M. Cullom.

Dr. M. M. Cullom reported a case as follows: On Sept. 18, 1923, he was consulted by R. H. D., age 28 years, white, male; referred by Dr. W. D. Haggard.

History: Patient has had foul discharge from both nostrils dating back to an attack of influenza in 1918. He is very thin, his color is very bad, yellowish green.

Examination: Examination disclosed both nostrils filled with offensive pus. Transillumination shows all sinuses dark. X-ray plate by Dr. Floyd confirms transillumination, showing all sinuses, except possibly the left frontal, involved.

Treatment: Sept. 19, 1923, did a double intranasal antrum operation under local anesthesia. Both antra filled with foul pus. Antra irrigated daily for ten days, at the end of which time the patient returned to his home in Florence, Ala.

Patient was seen again in two months. Both antra irrigated and solution returned clear. Right ethmoid region bathed in pus and patient told that ethmoid should be exenterated in the hope that it would help drainage from the frontal sinus or in the event it did not result in a clearing up of the frontal sinus, it would be the preliminary step in the frontal sinus operation. Patient was unable to come until Jan. 20, 1924, when the ethmoid labyrinth was exenterated.

Apr. 15, 1924, patient was again seen. Both antra irrigated and solution returned clear. Large amount of pus draining from the region of the frontal duct. Patient told that a radical frontal sinus operation was necessary.

May 17, 1924, patient returned. X-ray by Dr. W. O. Floyd showed involvement of the frontal sinuses on both sides. Showed unusually large frontals extending from external angular process of the frontal bone to hair line.

May 19, 1924, operation under ether anesthesia. Technique of Lynch employed. Insertion of post-nasal plug, nose swabbed out with 50 per cent iodin, teeth swabbed with iodin, skin washed with alcohol and ether, iodin applied to skin up to eye lashes on both sides. Killian incision through brow down side of nose. Periosteum elevated only from lower margin of wound. Entrance to sinus effected with mallet and chisel. As soon as sinus was opened profuse discharge of pus encountered. Bleeding profuse and difficult to control, delaying operation. Entire floor of frontal sinus removed and mucous membrane curetted from lining. Perforation found connecting with left sinus. This was enlarged and great quantity of pus drained out. Septum packed with gauze soaked in iodin while bone was being removed from ethmoid region, including paper plate of ethmoid. Large opening made into nose. Half inch drainage tube introduced from sinus down into nose. Skin closed with one deep catgut suture. The skin incision was closed with skin clip. Patient returned to bed in excellent condition. Time of operation, two hours and fifty minutes.

DISCUSSION.

DR. W. G. KENNON thought the X-rays in this case were not sufficiently clear to justify a diagnosis of frontal sinus trouble.

DR. EUGENE ORR also spoke of the difficulty encountered in getting reliable X-ray pictures in sinus conditions.

DR. ROBERT SULLIVAN considers X-ray plates of doubtful value in the diagnosis of ethmoid and sphenoidal trouble.

DR. FRED HASTY stated that he had had the pleasure of being with Dr. Cullom in this operation. The anatomy and pathological findings were very instructive. For instance, there was a very deep supra-orbital ethmoid cell extending back and behind the orbital cavity. This structure alone would have defeated the success of any intranasal operation. The septum between the right and left frontal sinus was perforated by the destructive process high up and there was quite as much, if not more pus in the left sinus than in the right in spite of the X-ray plate which indicated more trouble on the right side. In his experience X-ray plates have been rather disappointing in diagnosing chronic sinusitis.

DR. HERSCHEL EZELL inquired as to whether any external deformity usually resulted from this operation.

DR. CULLOM (closing) stated that this was the third Lynch operation he had done. In one case the result is apparently perfect. In the other, the patient has considerable general trouble aside from the sinusitis. The last time he saw her, however, there was no pus. There is no external deformity as a result of the operation. From Dr. Lynch's reports, as well as from his personal experience, Dr. Cullom believes this the best frontal sinus operation thus far devised.

He remarked that it has been claimed that Lynch has not given anything new in this operation. In Dr. Cullom's opinion he has taken details from the various operations and combined them into one operation and has thus gotten an excellent technique.

IN MEMORIAM—DR. CHARLES E. PERKINS.

Dr. Charles E. Perkins was born in Ohio, in 1857, was a graduate of P. and S., Columbia University, 1888. Immediately after his graduation he went West for a number of years, but returned to New York in 1906, at which time he became Clinical Assistant in Otology at the New York Eye and Ear Infirmary. In 1908 he was appointed Assistant Surgeon to this instiution and in 1919, he was appointed Attending Surgeon in Otology, which position he held at the time of his death. He was also Clinical Professor of Otology at the University and Bellevue Hospital Medical College, which position he had occupied since 1916. For a number of years prior to this time, he had done excellent work in the College Clinic, and the success of the College Clinic was very largely due to his untiring efforts. The same may be said of the out-Patient Department of St. Luke's Hospital. Dr. Perkins was a faithful worker in this department for many years. With the establishment of the special otological department at St. Luke's, he was immediately appointed Associate Otologist to the Hospital. All of these positions he held at the time of his death.

In 1918 Dr. Perkins entered the Medical Corps of the U. S. Army, and served a number of months abroad, retirng with the rank of Captain. In addition to these positions, he was a member of the New York Academy of Medicine, the New York Otological Society, and of the American Otological Society. In 1916 Dr. Perkins' "Manual of Otology" was published, which has been used as a text-book in many medical schools throughout the country.

Few knew Perkins well. He was retiring in manner but possessed a fund of information of which any man might be proud. His loss will be deeply felt not only by his friends, and his patients, but by the institutions which he served so faithfully. Scientific Otology has lost much by the untimely death of Dr. Perkins.